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A PHENOMENOLOGICAL INVESTIGATION OF VOLUNTARY EXITS FROM THE ATMOSPHERIC SCIENCE OCCUPATION

A DISSERTATION APPROVED FOR THE
SCHOOL OF METEOROLOGY

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DEDICATION

To my participants: It is not exaggerating to say that I could not have done this without you. Thank you for taking the time to speak with me. I hope I have done your narratives justice, and I hope that aspiring atmospheric scientists (stayers and leavers) benefit from your involvement.

To my informants: I also could not have done this without you. Thank you for helping spread the word about my study.

To John: I doubt you expected a doctoral student from Oklahoma to email you six years after your paper was published, and I certainly did not expect you to reply with such enthusiasm. I doubt this dissertation would exist if it were not for your paper and your encouragement. You have been an incredible mentor, and I am so grateful for your support.

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To Richard, who told me: “To live well is to change often.”

To my students, past, present, and future: You are the reason I have chosen this topic. I have every hope for you and confidence in you. I wish you success on your own terms.

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ABSTRACT

Data available from several atmospheric science (including meteorology) degree programs suggest that a sizable number of degree-holding atmospheric scientists may work outside of the atmospheric science occupation. In cases of voluntary occupational turnover, it is likely that leavers and their former employers are paying substantial costs, and the reasons they left may reflect poorly on working conditions in the occupation. Unfortunately, the bulk of the existing literature on voluntary occupational turnover has several weaknesses and lacks context relevant to atmospheric science. The purpose of this study is to understand the roles played by occupational factors in voluntary exits from the atmospheric science occupation, in order to identify areas for improvement and thereby ensure the continued health of the occupation. A descriptive psychological phenomenological approach was used to uncover the general structure of the experience of voluntarily exiting the atmospheric science occupation, without relying on existing turnover variables and models. Semi-structured interviews were conducted with degree-holding atmospheric scientists who self-identified as having worked in the occupation for at least several months before voluntarily exiting it. This type of data collection was used to gather detailed qualitative data on the exit experience in order to better inform and motivate future data collection. The general structure of voluntarily exiting the atmospheric science occupation is that of filling needs that cannot be filled while staying in the occupation. Needs may center upon escaping an undesirable work environment, being able to do meaningful work, having security, and being physically present with loved ones. Issues related to imbalanced supply-and-demand and the nature of working in the occupation, such as lack of hiring or geographically-available jobs,

prohibitive competition and educational or experience requirements, and lack of appealing jobs, may prevent working atmospheric scientists from filling their needs while staying in the occupation. These results are discussed in light of existing voluntary occupational turnover research and investigations of oversupply in the atmospheric science occupation. Additionally, the participants evaluated the avoidability of their exits and whether or not they would consider returning to the atmospheric science occupation in the future. Their answers to these questions give further insight into areas for improvement.

1. Introduction

"We define ourselves, and are defined by others, by what we do: our work" (Sarason 1977, p. 21).

a. Problem statement

1) THE PROBLEM OF DATA COLLECTION ON ATMOSPHERIC SCIENTISTS

Detailed data collection on degree-holding atmospheric scientists'[1] employment is lacking. The decline of the American Meteorological Society (AMS)/University Corporation for Atmospheric Research's (UCAR) *Curricula in the Atmospheric, Oceanic, Hydrologic, and Related Sciences*[2] guide is one of the most significant reasons for this lack. Beginning in 1964, atmospheric science departments in the United States and Canada reported detailed data on their graduates, such as the number and types of degrees granted and the types of jobs graduates took, for biennial publication in the *Curricula*. In 2000, the AMS and UCAR converted the *Curricula* from a printed guide into a continuously updated online database. Several atmospheric scientists used *Curricula* data to examine graduation and employment trends, gender-related issues, and the types of classes offered by different atmospheric science degree programs (LeMone and Waukau 1982; Mass 1996; Winkler et al. 1996; Vali et al. 2002; Cohn et

[1] The broad classification used for atmospheric scientists, which includes meteorologists, follows the Bureau of Labor Statistics' *Occupational Outlook Handbook* (OOH) classification (BLS 2017). Per the OOH, atmospheric scientists can include weather forecasters, research meteorologists, broadcast meteorologists, atmospheric physicists, climate scientists, and others. This classification is similar to Knox's (2008) use of "meteorologists" to include atmospheric scientists, atmospheric physicists, and climate scientists. Please refer to Appendix D for participant backgrounds to see how they fall under this broad classification.

[2] Older names include the *Curricula in the Atmospheric Sciences*, *Curricula in the Atmospheric and Oceanographic Sciences,* and *Curricula in the Atmospheric, Oceanic, and Related Sciences*.

al. 2006; Knox 2008; Hartten and LeMone 2010, 2014). Knox (2008) lauded the *Curricula* for its timeliness and breadth of information compared to broader graduation and employment data from the National Center for Education Statistics (NCES) and Bureau of Labor Statistics (BLS), and attendees of the 15th Biennial Heads and Chairs Meeting discussed enhancing the *Curricula*'s scope to include sharing departmental data, thereby making it "the premier resource for all uses in terms of information about university programs and career opportunities in the atmospheric sciences" (Charlevoix et al. 2007, p. 1632). However, voluntary reporting by degree programs to the *Curricula* began to drastically between the late-1990s and mid-2000s (Knox 2008; Hartten and LeMone 2014), and examination of Internet archives reveals that the *Curricula* ceased to exist as an online database by the late 2000s.

Individual atmospheric science departments have not picked up the slack in reporting on their graduates' employment since the *Curricula*'s decline. I systematically accessed 144 atmospheric science departmental websites through the AMS/UCAR's list of Schools in the Atmospheric, Oceanic, Hydrologic, and Related Sciences (AMS 2017). At the time of my search, about 100 of those departments—including many that had previously reported to the *Curricula*—did not publicize information on their graduates' employment on their websites. I contacted several departments, and some reported that they did not collect their graduates' employment information at all. The remaining 44 departments published some information on their graduates' employment to their websites, usually in the form of a few alumni profiles or spotlights. Only 12 of those departments published substantial information on their graduates' employment

that could be used to calculate meaningful percentages on their graduates' employment, either through categorical breakdowns of job type or through comprehensive lists of alumni.

AMS membership surveys provide the next-most-detailed data on atmospheric scientists. The AMS began surveying its general membership in 1975 (Kellogg 1977) and conducted similar surveys in 1990 (Stephens and Kazarosian 1992), 1993 (Zevin and Seitter 1994), 1999 (Michaels et al. 2001), 2005 (Murillo et al. 2008), and 2014; they also surveyed private sector meteorologists in 1995 (Houghton et al. 1996; Newman 1997). The AMS general membership surveys present largely categorical and quantitative work-related data on their members, such as: employment type, position, and status; salaries; geographic location; age, gender, and ethnic background; educational background; and years of experience. Several atmospheric scientists have used these data in studies of gender- and diversity-related issues (Bacon-Bercey 1978; LeMone and Waukau 1982; Winkler et al. 1996). Furthermore, the 1993, 1999, and 2005 surveys included questions about members' personal circumstances and workplace environments and their impacts on professional development; however, only Michaels et al. (2001) reported analysis of responses to those questions. Thus, although general employment numbers are available through AMS surveys, they provide minimal insight into what it is like to work within the atmospheric science occupation beyond average salaries and desirable skills. Additionally, their sporadic publication makes identification and analysis of graduation and employment trends difficult.

The NCES and BLS publish consistent data on annual graduations and employment in many fields and occupations, including atmospheric science. The NCES

Digest of Education Statistics, which was established in 1962, has given the number of annual atmospheric science, meteorology, and related degree conferrals at all levels since 1971. The BLS has reported on wage and salary workers in atmospheric science[3] annually in their Occupational Employment Statistics (OES) survey since 1997, and they have reported biennially on those wage and salary workers as well as self-employed atmospheric scientists in the *Occupational Outlook Handbook* (OOH) since 1959. These resources provide useful numbers for identifying broad graduation and employment trends, including annual degree conferrals and total annual employment, but they give little insight into what it is like to work within the atmospheric science occupation beyond salary ranges and general industry titles.

In summary, data on atmospheric scientists' employment that is both consistent and detailed is lacking. The most consistent data are broadly categorical and provide little insight into what it is like to work within the atmospheric science occupation. The most detailed data, which originate from within the occupation itself, are sparse: Data is collected and reported upon only sporadically, and data collection has been declining for decades.

2) THE PROBLEM OF MONITORING THE HEALTH OF THE ATMOSPHERIC SCIENCE OCCUPATION AND EMPLOYMENT

The lack of consistent and detailed employment data on atmospheric scientists inhibits monitoring the health of the occupation. This is especially true of data that illuminate what it is like for atmospheric scientists to work in the occupation, such as:

[3] "Atmospheric and space scientists" excludes atmospheric scientists who teach at the postsecondary level. These workers are grouped with other physical scientists and cannot be disaggregated.

evaluations of their job or career satisfaction; descriptions of their most used knowledge and skills, and evaluations of how well these were developed during college; evaluations of their preparedness to enter the workforce upon graduation; perceptions of current and future employment opportunities; descriptions of how they expect those opportunities will affect their professional development; and catalogues of their workplace concerns. Without monitoring workers' experiences, leaders in professional and educational organizations cannot address work-related issues, trends, or knowledge gaps as they arise, and they are inhibited from constructing useful programs, activities, benefits, and other opportunities for current and aspiring atmospheric scientists.

Other physical sciences provide examples of how atmospheric science organizations could monitor graduates. Starting in 2012, the American Institute of Physics (AIP) Statistical Research Center began releasing regular reports on degree-holding physicists and astronomers' employment soon after graduation (Anderson and Mulvey 2012, 2013; Tesfaye and Mulvey 2012ab, 2014; Mulvey and Pold 2014, 2015; Pold and Mulvey 2015ab, 2016abcd) and 10 to 15 years after graduation (Czujko and Anderson 2015abc). They collected data by asking physics and astronomy departments to provide information about their graduates. They also directly sent follow-up surveys to graduates for whom they had current contact information, and they asked those responders to provide updated contact information for other graduates. Their reports include traditional categorical and quantitative employment data like those collected by AMS surveys, such as: employment by status, type, and occupation; demographics; educational background; and typical salaries. They also provide data on graduates' job duties; regularly used knowledge and skills; satisfaction with various aspects of their

jobs: descriptions of the most rewarding aspects of their jobs; perceptions of intellectual challenge, autonomy, and appropriateness of their current employment; reasons for accepting their current employment; perceptions of underemployment; and desired types of future employment. These latter data especially shed light on what it is like for physics and astronomy graduates to work both inside and outside those occupations.

Similarly, in 2013, the American Geosciences Institute (AGI) began tracking the actual and intended employment of new geoscience[4] graduates in order to assess their attitudes; identify knowledge and experience gaps that inhibit entry into the workforce; and establish a benchmark for a detailed longitudinal study of the career pathways of early career geoscientists. They gathered data by sending geoscience departments the Geoscience Student Exit Survey to disseminate to their alumni, and they analyzed the data for their Status of Recent Geoscience Graduates reports. Voluntary participation in this survey has grown since its inception, from 71 departments in 2013 (Wilson 2013) to 163 in 2014 (Wilson 2014a) to 210 in 2015 (Wilson 2015). Besides capturing traditional employment, educational, and demographic data like the AMS and AIP, these reports also describe the resources employed geoscientists used to find employment and the number of job offers they received before taking their current jobs.

The benefit of consistently collecting data on atmospheric scientists' work experiences is that organizations like the AMS can publicize issues to their entire membership and create committees to focus on making improvements and addressing obstacles. Michaels et al.'s (2001) analysis of the 1999 AMS membership survey gives

[4] Geoscience graduates include a small number of atmospheric scientists (about 2%), and is dominated by solid earth sciences like geology, geophysics, and geochemistry.

a glimpse into the value of monitoring the health of the atmospheric science occupation through careful data collection and analysis. The 1999 survey was the first—and so far, the only—AMS membership survey for which analysis of data on the effects of personal and workplace circumstances on the professional development of atmospheric scientists was published. In fact, to help anticipate supports and obstacles in a diversifying workforce and identify areas needing improvement, the AMS Board on Women and Minorities restructured this section of the 1999 survey in order to enable careful, detailed data analysis. Demographic data indicated that women, minorities, and individuals with disabilities were underrepresented among AMS members; analysis of data on personal and workplace circumstances was able to give a deeper look into their perceptions about working in the atmospheric science occupation, as well as the perceptions of other responding members. Analysis revealed that a sizable percentage of respondents, which roughly corresponded to the number of members in these underrepresented groups, felt that their marital status, race/ethnicity, gender, and/or dependent care hindered their salaries and/or skill acquisition. Women also indicated more often than men that the career advancement of underrepresented groups was not at an acceptable level. Written suggestions uncovered other workplace issues, and even those short written responses provided detail and depth not reflected in quantitative data. The authors noted that they uncovered important new concerns through their analysis, and 84% of responding women and 55% of responding men felt that the AMS should address workplace issues in the future. Unfortunately, analysis was not published on this section for the following 2005 AMS membership survey.

Mass (1996), Pielke (2003), and Knox (2008) have highlighted the necessity of monitoring the health of the occupation by drawing attention specifically to the effects of chronic oversupply of atmospheric science graduates. Most recently, Knox (2008) presented two-year averages of atmospheric science bachelor's degree conferrals as measured by the NCES between the 1967-68 and 2003-04 academic years, biennial BLS OOH estimates of the total number of employed atmospheric scientists, and *Curricula* data reported by 34 institutions on their graduates' employment. Using these data, he pointed out that average total atmospheric science job growth between 1994 and 2004 was about four times slower than growth in atmospheric science bachelor's degree conferrals. This difference was especially stark for entry-level positions, where his analysis of job posts in the *Meteorological Employment Journal* and the *National Weather Service Focus* publications and estimates of military positions suggested that there were only about half as many annual entry-level jobs as new bachelor's degree recipients. Furthermore, starting salaries for atmospheric science bachelor's degree recipients as reported by the National Association of Colleges and Employers (NACE) were depressed compared to other scientific, mathematical, and technical occupations—a signal of chronic oversupply.

I have been able to nearly replicate Knox's (2008) bachelor's degree conferral and total employment numbers using NCES and BLS OOH data, respectively. At the time of his study, which included the 2003-04 academic year, annual bachelor's degree conferrals were rising as part of an upward, roughly-linear trend that began in 1990 (Fig. 1). From the 2005-06 academic year through the 2013-14 academic year, bachelor's degree conferrals held rather steady at a record high of about 725 annually,

totaling 7,134 new bachelor's degree recipients between the 2004-05 and 2013-2014 academic years.[5] In contrast, total employment in the atmospheric science occupation grew by about 4,400 positions between 2004 and 2014 (Fig. 2). Furthermore, for nearly every two years since the mid-1980s, the supply of new bachelor's degree recipients has outpaced the addition of new atmospheric science jobs (Fig. 3). Overall, these trends indicate that there may be a general lack of atmospheric science jobs for graduates. While Knox (2008) was able to approximately quantify the specific lack of entry-level jobs for new graduates, the *Meteorological Employment Journal* no longer exists, and job listings available through the AMS's online Career Center and USAJobs are not archived. Additionally, NACE no longer reports on the starting salaries of atmospheric scientists.

Based on Knox's (2008) analysis and my supplement, one could surmise that some "extra" atmospheric science graduates by necessity find employment outside of the atmospheric science occupation. The little employment data available from the *Curricula*'s final years as reported by Knox (2008, his Appendix F) indicate that, at the time they were surveyed, about 4% to 6% of atmospheric science bachelor's degree recipients from 34 reporting institutions worked in "Other" areas outside of the atmospheric science occupation. (Unfortunately, the number of "Unknown" job choices was between about 27 and 28 percent.) Reporting by atmospheric science departments to the *Curricula* was already low at the time of Knox's (2008) study, and finding more

[5] Master's and doctoral degree conferrals have also grown during the same time period and may have added up to about 3,000 additional degree-holding atmospheric scientists; however, the NCES does not provide enough information about outcomes to avoid double- or triple-counting graduates who hold multiple atmospheric science degrees, and so master's and doctoral degree data is not included in this discussion.

recent corroborating numbers is even more difficult, since there is no longer a centralized source of detailed employment data like the *Curricula*. To try to supplement this data, I looked to the 12 departmental websites noted above that posted substantial information about their graduates, although the reliability of their data collection methods is unknown (e.g., How often do they reach out to graduates to update their employment information? What percentages of their graduates have responded? Are percentages based on graduates' most recent employers, their starting employers, or a mix?), and the data must be considered with caution. Calculations are given below for several of those departments; departments with a prohibitive number of unknowns or who aggregated atmospheric science graduates with other geoscience graduates are omitted.

- According to the Job Placement section of Penn State's Department of Meteorology and Atmospheric Science's website (Penn State 2016), 7% of their 2012-2015 bachelor's degree recipients (total number not given) work in non-scientific fields. About 1% works in the academic sector; 30% attend graduate school; 47% work in the private sector; 3% work in the public sector; and 3% work in the military. The employment status of about 9% of their alumni is listed as unknown.
- San Jose State University's Department of Meteorology and Climate Science posts information about the employment outcomes of 236 bachelor's and master's degree recipients, as well as their names and contact information (San Jose State University 2017). Based on this information and my own search, about 14% of their alumni work outside of the atmospheric science occupation; 14% work in the academic sector; 24% work in the private sector; 27% work in the public sector; and 2% work

in the military. The employment status of about 19% of their alumni is listed as unknown.

- State University of New York (SUNY) at Brockport' Department of Earth Sciences posts information about the employment outcomes of 43 graduates (SUNY Brockport 2014). Based on this information, about 21% of their alumni work outside of the atmospheric science occupation; 5% work in the academic sector; 14% attend graduate school; 42% work in the private sector; 12% work in the public sector; and 7% work in the military.
- The University of Alaska at Fairbanks's Department of Atmospheric Sciences posts information about the employment outcomes of 53 graduates (University of Alaska Fairbanks 2016). Based on this information, about 11% of their alumni work outside of the atmospheric science occupation; 28% work in the academic sector; 12% attend graduate school; 4% work in the private sector; and 11% work in the public sector. The status of about 35% of their alumni is listed as unknown.
- Millersville University's Department of Earth Sciences posts information about the employment outcomes of many of their meteorology graduates, as well as their names (Millersville University 2017). The 192 graduates who graduated between 2000 and 2016 were used for the following calculations. Based on posted information and my own search, about 6% of their alumni work outside of the atmospheric science occupation; 9% work in the academic sector; 27% attend graduate school; 38% work in the private sector; 17% work in the public sector; and 3% work in the military. The status of less than 1% of their alumni is listed as unknown.

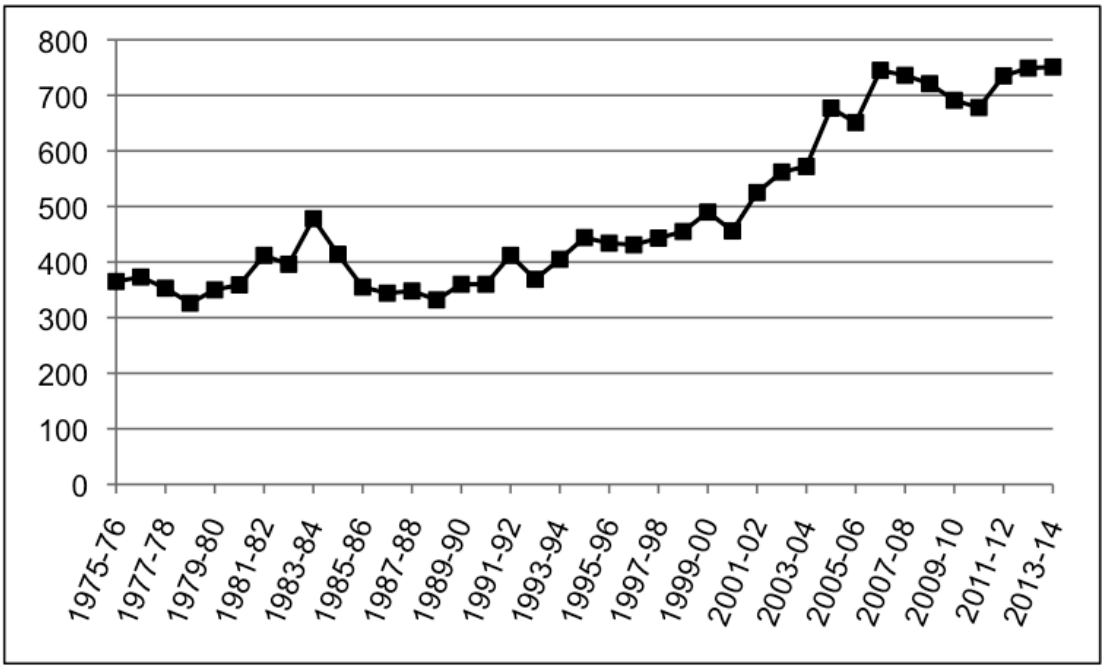

FIG. 1: Annual number of U.S. bachelor's degree conferrals in Atmospheric Sciences and Meteorology instructional programs for the 1975–76 through 2013–14 academic years, compiled from data published in the NCES *Digest of Education Statistics*. Markers are placed for every academic year.

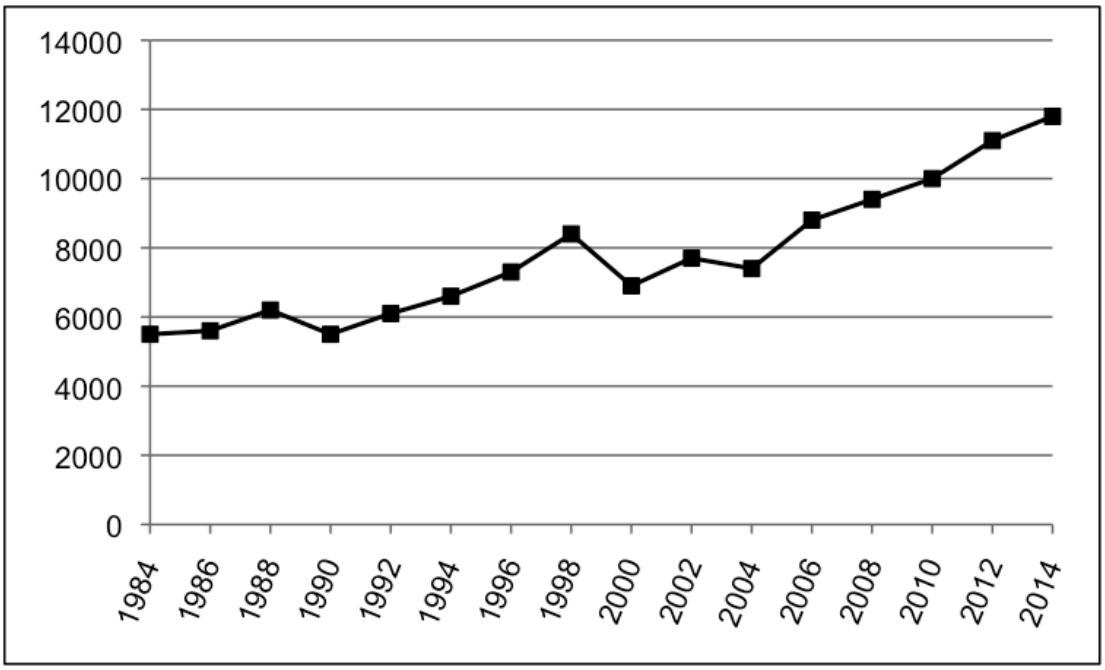

FIG. 2: Total employment in the atmospheric science occupation in the U.S., compiled from data published biennially in the BLS OOH. Markers are placed for every biennial edition of the BLS OOH.

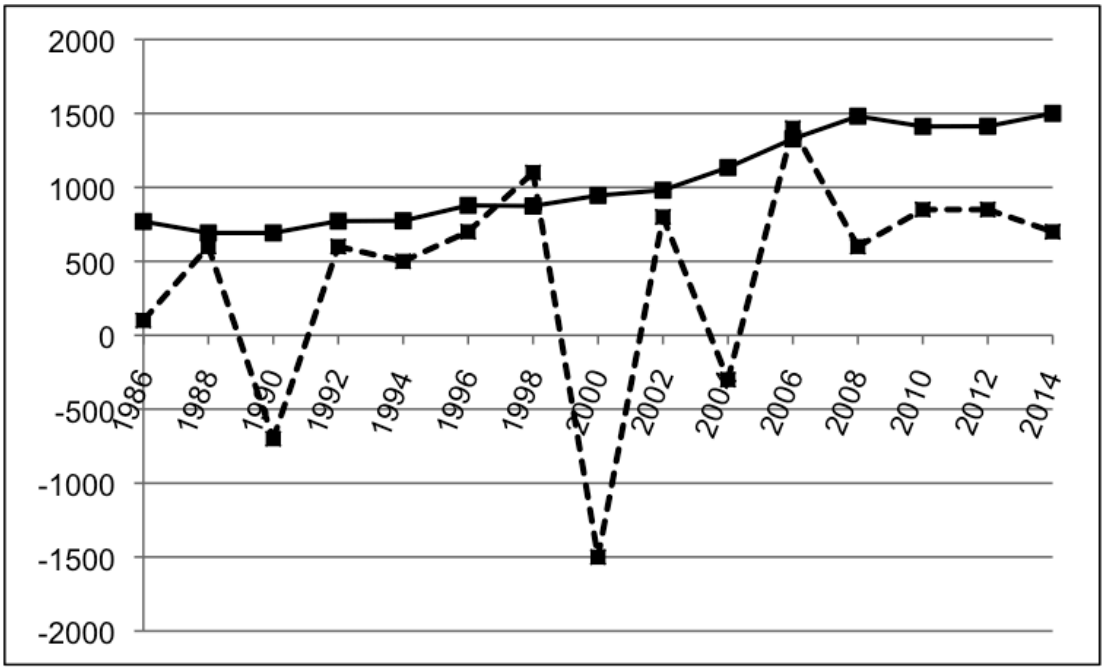

FIG. 3: Total two-year U.S. bachelor's degree conferrals in Atmospheric Sciences and Meteorology instructional programs (solid line) for the combined 1984–85 and 1985–86 academic years (labeled as "1986") through the combined 2012–13 and 2013–14 academic years (labeled as "2014"), compiled from data published in the NCES *Digest of Education Statistics*. Two-year change in total employment in the atmospheric science occupation (dashed line), compiled from data published biennially in the BLS OOH. Markers are placed every two years.

For perspective, these percentages of atmospheric scientists who work outside of the occupation can be compared to the BLS's most recent report on occupational mobility, which quantifies change from one occupation to another (Schniper 2005). Between January 2003 and January 2004, about 7% of all workers changed occupations. The percentages listed above on atmospheric scientists working outside of the occupation are most similar to occupational exits from food preparation- and serving-related occupations (20%), sales-related occupations (11%), office and administrative support (9%), transportation and material moving (9%), personal care and service (8%), healthcare support (8%), and arts and media (7%). They generally are higher than exits reported for life, physical, and social science occupations (6%), computer and

mathematical science occupations (4%), and architecture and engineering occupations (3%).

The National Science Foundation (NSF) provides one more signal that a perhaps sizable number of degree-holding atmospheric scientists may be working outside of the occupation, although one must keep in mind that the NSF aggregates atmospheric scientists with Earth and oceanic scientists; I was told that granular data were not available for atmospheric scientists, and Earth scientists likely dominate this group. Since the early 1970s, the NSF has populated their Scientists and Engineers Statistical Data System (SESTAT) with longitudinal education and employment data on degree-holding scientists and engineers in the U.S collected from their National Survey of Recent College Graduates (discontinued in 2010), National Survey of College Graduates, and Survey of Doctorate Recipients biennial surveys. According to aggregate data from 2013, 45% of Americans younger than 76 years old who hold their highest degrees in Earth, atmospheric, or oceanic sciences work in science and engineering (S&E) occupations (32% in the physical and related sciences); 14% work in S&E-related occupations such as pre-college teaching and health; and 40% work in non-S&E occupations such as social services and sales and marketing. Isolating just bachelor's degree recipients, 30% work in S&E occupations (17% in the physical and related sciences); 12% work in S&E-related occupations; and 52% work in non-S&E occupations. Although these percentages are likely dominated by Earth scientists, they are alarming when compared with the occupational mobility data listed above.

Based on Knox's (2008) analysis and my extension, the above data undoubtedly capture instances where degree-holding atmospheric scientists never worked in the

atmospheric science occupation at all after graduation, and instead took work outside of it by necessity or by choice. Even more concerning are instances where individuals voluntarily chose to leave the atmospheric science occupation after obtaining employment in it and working in it for some time. These instances are concerning since voluntary turnover can serve as an index of occupational health (Hinkin and Tracey 2000; Morrell et al. 2004b), and as will be discussed in detail in the next sub-section, voluntary occupational turnover can reflect poorly on occupational working experiences.

Unfortunately, NCES, BLS, and NSF data do not contain enough detail to quantify voluntary occupational turnover from atmospheric science, and the lack of detailed and consistent employment data gathered from within the atmospheric science occupation itself prevents tracking graduates who do not work in the occupation and investigating their circumstances. Decades ago, both Mass (1996) and Knox (2008) already identified the lack of data originating from inside the occupation as preventing monitoring the health of the occupation, and Knox (2008) noted: "Worse yet, the *Curricula* has declined markedly in comprehensiveness at exactly the moment of greatest growth in meteorology and the greatest need for reliable statistics" (p. 881). Growth of the field through graduations has continued essentially unabated since Knox's (2008) study (Fig. 1), and the lack of detailed employment data is even worse today than it was in 2008, but I have not been able to identify any organized efforts to bring a field-wide employment database back into existence, despite Mass (1996) and Knox's (2008) calls for better tracking of atmospheric science graduates' employment.

Tracking continues to be needed, especially since there now is indication that many degree-holding atmospheric scientists may be working outside of the occupation.

3) THE PROBLEM OF VOLUNTARY OCCUPATIONAL TURNOVER

"[O]ur society has made it easier to change marriage partners than to change careers" (Sarason 1977, p. 71).

Working in an occupation offers individuals a wealth of benefits. Beyond supporting their basic biological needs by earning money, individuals can express themselves through their choice of occupation; satisfy their desires for challenging, interesting, impactful, and enjoyable work; gain new skills and outlooks; achieve goals; obtain power, status, and stability; and connect with others (Super 1953, 1963, 1990; Super and Bachrach 1957; Holland 1959, 1966, 1973, 1985, 1997; Carson et al. 1995, 1996; Carson and Carson 1997; Savickas 2002, 2005; Pryor and Bright 2003, 2014; Blustein 2006). These benefits are so pervasive, "Sociologists view an occupation as a basic link between an individual and the rest of society" (Wilson and Green 1990, p. 209).

Individuals invest time, money, and mental energy in pursuing their chosen occupations in order to enjoy these benefits. Yet, some individuals may give up these benefits and pay a variety financial, social, psychological, and even physiological costs to voluntarily exit their occupations after years of effort and entrenchment. Costs include: breaking ties with familiar people and settings; adjusting to new situations and relative inexperience in new occupations; losing occupational contacts; giving up seniority and a place in the promotion queue; abandoning nontransferable skills; foregoing income to train for new occupations, find work in them, and/or advance in

them; losing employer-supplied insurance and investment matching; enduring the social stigma and/or loss of status associated with leaving an occupation; experiencing loss of identity and/or internal conflict; feeling guilty and/or useless due to breaking what is seen as a social obligation; and possibly disrupting personal and/or family life (Spilerman 1977; Osherson 1980; Neapolitan 1980; Nicholson 1984; Markey and Parks 1989; Holmes and Cartwright 1993; Wrightsman 1994; Serow and Forrest 1994; Carson et al. 1995, 1996; Teixeira and Gomes 2000; Feldman 2002; Morrell et al. 2004a; Maertz and Griffeth 2004; Wise and Millward 2005; Feldman and Ng 2007; Motulsky 2010; Sian 2013; Ahn 2016; Fouad et al. 2016). The pain of paying such costs can motivate some individuals to remain in their occupations rather than exit them, even when they are dissatisfied, conflicted, or unfulfilled by their work (Neapolitan 1980; Perosa and Perosa 1984; Cherniss 1989; Kanchier and Unruh 1989; Harper 1995; Carson et al. 1995, 1996; Carson and Carson 1997; Maertz and Griffeth 2004; Wise and Millward 2006; Blau 2007; Feldman and Ng 2007; Sian 2013; Brown et al. 2015). Thus, instances of voluntary occupational turnover point to the presence of powerful motivational forces that are able to overcome potent cost barriers.

Employing organizations also pay a variety of costs when valuable employees leave as part of voluntary occupational turnover (Dalton et al. 1981, 1982). Many studies suggest that highly educated, experienced, and/or skilled employees are more likely to voluntarily exit their occupations, including employees that have higher probabilities for promotions but do not receive them, as they are thought to have the most opportunities to transition to other occupations (Cabral et al. 1985; Kanchier and Unruh 1989; Markey and Parks 1989; Sicherman and Galor 1990; Harper 1995; Higgins

2001; Luzius and Ard 2006; Rathbun-Grubb 2009; Carless and Arnup 2011; Hwang et al. 2011; Howes and Goodman-Delahunty 2015; Kesse 2015). Loss of skilled employees can lower an employing organization's performance; interrupt customer service; decrease organizational memory; put additional responsibilities on remaining employers; exhaust supervisors who must train and monitor new employees; disrupt morale, citizenship, and cohesion; and even encourage other employees to leave. Employers lose their investments in recruitment, selection, training, and professional development when employees leave, and they may need to spend prohibitive amounts of money on turnover-related costs such as overtime or temporary staffing as well as recruitment, selection, training, and development of new employees; this can become very costly in occupations with high turnover (Dalton et al. 1981, 1982; Dalton and Todor 1982; Abelson and Baysinger 1984; Krausz et al. 1995; Macdonald 1999; Hinkin and Tracey 2000; Ewing and Smith 2003; Whitebook and Sakai 2003; Morrell et al. 2004ab; Ton and Huckman 2008; Holtom et al. 2008; Lee et al. 2008; Allen et al. 2010; Hancock et al. 2011; Fouad et al. 2016). Although costs are occupation and organization dependent, several researchers have found that the turnover costs an employer will pay for a single leaver are typically about 20% to 30% of the leaver's annual salary, and may be even double their salary if they worked in a senior level position (Johnson 1995; Hinkin and Tracey 2006; Tracey and Hinkin 2008; Allen et al. 2010; Boushey and Glynn 2012; Mitchell et al. 2001a).

Beyond employers, occupations as a whole ultimately lose out on potential scientific contributions; recruitment of new workers; and leaders and mentors when individuals voluntarily leave. Consequently, turnover researchers wish to understand

voluntary occupational turnover in order minimize, when possible, such undesirable costs for leaving individuals, their former employers, and their former occupations. The following discussion reviews the literature on voluntary occupational turnover from three perspectives: Leaving, staying, and engaging in related withdrawal cognitions and behaviors.

(i) Studies on leaving

Answering the question, "Why do individuals voluntarily leave their occupations?" has driven turnover research in psychology, sociology, economics, and management since the 1970s. For the most part, turnover research can be divided into labor market and psychological camps (Lee and Mitchell 1994; Morrell et al. 2004a; Tanova and Holtom 2008). Labor market studies seek to uncover large-scale trends in occupational turnover that relate external economic dynamics with personal characteristics such as demographics, educational attainment, marital status, occupational tenure, and occupational group (Rytina 1982; Sehgal 1984; Markey and Parks 1989; Harper 1995; Schniper 2005; Parrado et al. 2007). These studies typically assume that workers in an occupation are homogeneous and make rational (i.e., sequential, systematic, and highly informed) decisions to maximize economic outcomes, and they typically analyze large samples of responses to longitudinal national surveys. In contrast, psychological studies—which have come to dominate turnover research and will be of greatest focus in this review—seek to explain why and how individuals voluntarily leave occupations, with greater focus on internal rather than external factors (Carless and Bernath 2011). Traditional psychological studies typically

administer cross-sectional, self-report surveys to large samples to identify individual-level correlates and antecedents of voluntary occupational turnover. While traditional psychological studies tended to assume that individuals rationally choose to leave their occupations, a growing number of psychological studies subscribe to "other-than-rational" (Phillips 1997) perspectives. According to such perspectives, decision-making is to a great extent non-sequential and non-systematic, and it is emotional, contextual, and subject to chance. Additionally, especially within the past couple of decades, more psychological studies are seeking an in-depth understanding of voluntary occupational turnover through openness to individual narratives rather than by using existing survey instruments and theories. These studies typically present qualitative analysis of semi-structured interviews with a small number of participants who can provide information-rich descriptions of their turnover experiences. Although meaningful statistical analysis cannot be done on such small samples, these studies have proved to be particularly adept at uncovering new aspects of voluntary turnover.

Studies from both camps have uncovered many correlates and antecedents of voluntary occupational turnover, the majority of which reflect negatively on leavers' former occupations. These types of factors are of special interest to turnover researchers because employers can address them and make improvements to working conditions. Satisfaction, which is defined as the extent to which an individual likes or dislikes some aspect of their work (Spector 1997), is the most popularly studied of such variables—by the start of the 1990s, Rosse (1991) found that there were over 1,000 studies connecting work-related satisfaction with voluntary turnover! Many studies have found that voluntary occupational leavers become dissatisfied with aspects of working in their

former occupations, including: the nature of occupational work, such as responsibilities or tasks, workload, pervasiveness of bureaucracy, or difficult scheduling (Sarason 1977; Cherniss 1989; Wrightsman 1994; Teixeira and Gomes 2000; Luzius and Ard 2006; Rathbun-Grubb 2009; McGinley et al. 2014; Way 2015; Brown et al. 2015); extrinsic rewards such as pay, promotions, training, or recognition (Neapolitan 1980; Cherniss 1989; Doering and Rhodes 1989; Holmes and Cartwright 1993; Wrightsman 1994; Blau 2007; Rathbun-Grubb 2009; McGinley et al. 2014; Brown et al. 2015; Kesse 2015); intrinsic rewards such as being challenged or inspired, gaining autonomy, seeing results, enjoying work, and putting their skills and interests to use (Krantz 1977; Neapolitan 1980; Sehgal 1984; Roborgh and Stacey 1987; Cherniss 1989; Doering and Rhodes 1989; Holmes and Cartwright 1993; Serow and Forrest 1994; Wrightsman 1994; Teixeira and Gomes 2000; Wise and Millward 2005; Blau 2007; Rathbun-Grubb 2009; Kesse 2015; Ahn 2016); work-life conflict (Wrightsman 1994; Teixeira and Gomes 2000; Rathbun-Grubb 2009; Brown et al. 2015); and negative interactions with supervisors, co-workers, or clients (Luzius and Ard 2006). Additionally, Neapolitan (1980), Doering and Rhodes (1989), de Croon et al. (2004), Rathbun-Grubb (2009), and McGinley et al. (2014) noted that some leavers changed jobs within their occupations but were unable to alleviate their dissatisfaction, since they were dissatisfied with aspects inherent to working in a particular occupation.

Apart from dissatisfaction, voluntary occupational turnover is also associated with other factors, many of which again reflect poorly on individuals' experiences in their former occupations. These include: lack of fit between interests or values and the type of work in an occupation and/or desire for better fit in another occupation (Krantz

1977; Thomas 1980; Herrick et al. 1983; Perosa and Perosa 1984; Kanchier and Unruh 1989; Wrightsman 1994; Wise and Millward 2005; Way 2015); lack of an/or desire for better growth and advancement opportunities (Hiestand 1971; Herrick et al. 1983; Lewis and Thomas 1987; Doering and Rhodes 1989; Kanchier and Unruh 1989; Serow and Forrest 1994; Macdonald 1999; Wise and Millward 2005; Luzius and Ard 2006; Hwang et al. 2011; Howes and Goodman-Delahunty 2014; Kesse 2015; Way 2015; Fouad et al. 2016); desire for better extrinsic rewards (Hiestand 1971; Rytina 1982; Herrick et al. 1983; Blau 1989; Doering and Rhodes 1989; Markey and Parks 1989; Sehgal 1984; Holmes and Cartwright 1993; Serow and Forrest 1994; MacDonald 1999; Whitebook and Sakai 2003; Luzius and Ard 2006; Howes and Goodman-Delahunty 2014); lack of fulfillment and/or desire for more meaningful work (Thomas 1980; Osherson 1980; Herrick et al. 1983; Perosa and Perosa 1984; Kanchier and Unruh 1989; Serow and Forrest 1994; Wrightsman 1994; Whitebook and Sakai 2003; Wise and Millward 2005; Williams and Forgasz 2009; Howes and Goodman-Delahunty 2014; Way 2015; Ahn 2016); experience or even disenchantment with significant changes in their former occupation (Wrightsman 1994; Feldman 2002; Whitebook and Sakai 2003; Feldman and Ng 2007; Howes and Goodman-Delahunty 2014); desire for better working conditions (Markey and Parks 1989); work exhaustion, stress, and burnout (Sarason 1977; Herrick et al. 1983; Blau 1989, 2007; Doering and Rhodes 1989; Wrightsman 1994; de Croon et al. 2004; Howes and Goodman-Delahunty 2014; McGinley et al. 2014; Way 2015); job insecurity and/or underemployment (Herrick et al. 1983; Sehgal 1984; Doering and Rhodes 1989; Serow and Forrest 1994; Wrightsman 1994; Feldman 2002; Carless and Arnup 2011; Hwang et al. 2011; Witchger 2011;

Kesse 2015; Ivie et al. 2016) work-life conflict, lack of support for work-life agreement, and/or desire for better work-life agreement (Sarason 1977; Thomas 1980; Herrick et al. 1983; Cherniss 1989; Wrightsman 1994; Feldman 2002; Whitebook and Sakai 2003; Wise and Millward 2005; Williams and Forgasz 2009; Witchger 2011; Sian 2013; McGinley et al. 2014; Brown et al. 2015; Kesse 2015; Way 2015; Ivie et al. 2016; Fouad et al. 2016); imposter syndrome (Sarason 1977; Wrightsman 1994; Ivie et al. 2016); bias and discrimination (Way 2015); conflict with co-workers, supervisors, and/or clients (Herrick et al. 1983; Howes and Goodman-Delahunty 2014; Way 2015; Ivie et al. 2016); disillusionment with bureaucracy (Herrick et al. 1983; Kanchier and Unruh 1989; Howes and Goodman-Delahunty 2014); and attraction to other, more desirable occupations through gaining positive experience in or learning about them (Neapolitan 1980; Herrick et al. 1983; Roborgh and Stacey 1987; Serow and Forrest 1994; Harper 1995; Betsworth and Hansen 1996; Feldman and Ng 2007; Rathbun-Grubb 2009; Williams and Forgasz 2009; Murtagh et al. 2011; Witchger 2011; McGinley et al. 2014; Kesse 2015; Ahn 2016).

As this discussion illustrates, there are many on- and off-the-job factors that may influence voluntary occupational turnover, and the sheer number of factors suggests that voluntary occupational turnover is a complex experience. This complication will be addressed in detail in a following sub-section.

(ii) Studies on staying

As an alternative to studying leaving, turnover researchers also investigate why individuals stay in their occupations. Retention typically has been operationalized through occupational commitment, which is defined as a multi-component

psychological state that characterizes a worker's attachment to their occupation (Blau 1985a; Meyer et al. 1993). The affective component of occupational commitment stems from emotional identification with an occupation. This type of commitment is built through positive occupational experiences and motivates a worker to maintain good feelings by staying in their occupation (Lee et al. 2000; Maertz and Campion 2004; Maertz and Griffeth 2004). The continuance component encompasses occupational "sunk costs" that include time, money, and energy spent on education, training, job search, and membership in professional organizations. This type of commitment motivates a worker to remain in an occupation rather than lose their investments. The normative component develops through occupational socialization, receipt of benefits through occupational work, and external pressure from colleagues, friends, or family to stay in an occupation. This type of commitment makes a worker feel obligated to remain in their occupation.

Blau (1985a) initially conceived occupational commitment[6] as strictly affective, and affective occupational commitment dominated commitment research for nearly two decades. Once Meyer et al. (1993) identified the continuance and normative components, researchers increasingly focused on these other dimensions. Carson et al. (1995, 1996; Carson and Carson 1997) expanded the continuance component into occupational entrenchment, which encompasses the temporal, financial, and social-psychological costs of leaving an occupation as well as the limitedness of occupational

[6] Blau (1985a) initially called occupational commitment "career commitment," but revised its name in Blau et al. (1993) to reflect the more focused nature of occupation than career. This change from "career" to "occupation" has been common in occupational turnover and retention research.

alternatives that results from continued focus on the current occupation. Ng and Feldman (2007) reconceptualized occupational commitment as occupational embeddedness, which encompasses the totality of forces—fit, links, and sacrifice—that keep an individual in their occupation. Fit is the extent to which an individual's abilities match occupational requirements and their interests match occupational rewards; links are the extent to which individuals have ties to other people and activities in their occupation; and sacrifice encompasses the losses an individual would occur by leaving their occupation. Occupational embeddedness has received very little study since its inception, but is mentioned here to give a more complete and nuanced picture of retention.

Unsurprisingly, the retention variables listed above are to varying degrees consistently and negatively correlated with, and even predict, withdrawal cognitions and behaviors that include occupational turnover (Blau 1985ab, 1988, 1989, 2000, 2007; Bedeian et al. 1991; Aryee and Tan 1992; Meyer et al. 1993; Aryee et al. 1994; Carson and Bedeian 1994; Carson et al. 1995, 1996; Irving et al. 1997; Blau and Lunz 1998; Ellemers et al. 1998; Chang 1999; Lee et al. 2000; Hackett et al. 2001; Blau et al. 2003; Snape and Redman 2003; Hall et al. 2005; Blau and Holladay 2006; Chang et al. 2007; Duffy et al. 2011; Hess et al. 2012; Fouad et al. 2016). In fact, Lee et al. (2000) found in their meta-analyses of 77 studies that occupational commitment is a better predictor of turnover intentions than job-related satisfaction.

Beyond its negative relationship with voluntary turnover, retention can be a boon for both workers and employers. For one, the retention variables discussed above correlate consistently and positively with job satisfaction, organizational commitment

and embeddedness, responsibility, work effort, job involvement, skill development, job performance, and citizenship behaviors like helping others (e.g., Blau 1985ab, 1988, 1989, 2000, 2001, 2003, 2007; Colarelli and Bishop 1990; McGinnis and Morrow 1990; Aryee and Tan 1992; Meyer et al. 1993; Wallace 1993; Blau et al. 1993; Aryee et al. 1994; Carson and Bedeian 1994; Carson et al. 1995, 1996; Irving et al. 1997; Blau and Lunz 1998; Ellemers et al. 1998; Lee et al. 2000; Hackett et al. 2001; Goulet and Singh 2002; May et al. 2002; Meyer et al. 2002; Blau et al. 2003; Snape and Redman 2003; Hall et al. 2005; Blau and Holladay 2006; Chang et al. 2007; Ng and Feldman 2009; Duffy et al. 2011). Furthermore, workers who stay in their occupations can acquire extrinsic rewards like higher salaries, promotions, pensions, status and prestige, and access to learning and training that increases their likelihood for advancement—all of which can motivate them to continue staying in their occupations (Rosen 1972; Neapolitan 1980; Cherniss 1989; Kanchier and Unruh 1989; Sicherman and Galor 1990;Harper 1995; Carson et al. 1996; Carson and Carson 1997; Chang 1999; Hall et al. 2005; Whitebook and Sakai 2003; Feldman and Ng 2007; Amundson et al. 2010; Brown et al. 2015). Persistence in an occupation also can help individuals find meaning in their work and feel more stable, secure, and in control of their work and personal lives (Neapolitan 1980; Cherniss 1989; Kanchier and Unruh 1989; Colarelli and Bishop 1990; Carson and Bedeian 1994; Carson et al. 1995, 1996; Carson and Carson 1997; Lee et al. 2000; Goulet and Singh 2002; Snape and Redman 2003; Hall et al. 2005; Blau and Holladay 2006; Amundson et al. 2010), and membership in an occupation can provide social rewards, such as familiarity, belongingness, and connectedness (Amundson et al. 2010). Finally, an atmosphere of embeddedness can encourage other

employees to maintain membership in an organization and also become embedded (Felps et al. 2009).

Many of the same or similar factors discussed in the previous sub-section that reflect poorly on individuals' occupational experiences also negatively correlate with retention variables: Dissatisfaction with extrinsic or intrinsic rewards; lack of advancement opportunities and/or desire for better advancement opportunities; lack of fit and/or desire for better fit; ambiguous job role requirements and responsibilities; lack of organizational support; job insecurity; work exhaustion, stress, and burnout; and work-life conflict (Blau 1985ab, 2000, 2001, 2003, 2007; Colarelli and Bishop 1990; Bedeian et al. 1991; Aryee and Tan 1992; Aryee et al. 1994; Chang 1999; Lee et al. 2000; Goulet and Singh 2002; May et al. 2002; Blau et al. 2003; Duffy et al. 2011). Thus, many of the same aspects of working in occupations that relate to voluntary turnover also relate to lower retention forces, and this can be painful to both individuals and their employers.

(iii) Studies on related withdrawal cognitions and behaviors

Many researchers consider a number of withdrawal cognitions and behaviors, including voluntary turnover, to be related to each other. These include: lowered job performance; psychological and behavioral avoidance of job involvement or organizational citizenship; lateness; absence; thinking about quitting; intending to leave a job or occupation; actual leaving; and early retirement (Lyons 1972; Muchinsky 1977; Gupta and Jenkins 1982, 1991; Clegg 1983; Rosse and Miller 1984; Blau 1985b, 1989, 1998; Rosse and Hulin 1985; Rosse 1988; Rusbult et al. 1988; Elsass and Ralston 1989; Roznowski and Hanisch 1990; Hanisch and Hulin 1990, 1991; Hulin 1991; Mitra et al.

1992; Carson et al. 1995, 1996; Carson and Carson 1997; Becker and Martin 1995; Hanisch 1995; Krausz et al. 1995; Koslowsky et al. 1997; Hanisch et al. 1998; Morrow et al. 1999; Koslowsky 2000; Hom and Kinicki 2001; Harrison et al. 2006; Burton et al. 2010). Any of these withdrawal cognitions and behaviors can be detrimental to workers and their employing organizations by reducing productivity, job performance, customer service, and morale.

Researchers have identified common antecedents for withdrawal cognitions and behaviors, although the specific type(s) of cognition or behavior that an individual engages in depends upon a blend of personal and external factors. Similar to the studies of voluntary occupational turnover discussed above, work-related dissatisfaction is the most commonly studied antecedent for withdrawal cognitions and behaviors (e.g., Muchinsky 1977; Rosse and Miller 1984; Rosse and Hulin 1985; Rosse 1988; Rusbult et al. 1988; Roznowski and Hanisch 1990; Hanisch and Hulin 1990, 1991; Hulin 1991; Gupta and Jenkins 1991; Mitra et al. 1992; Hanisch 1995; Koslowsky et al. 1997; Rosse and Miller 2000; Hom and Kinicki 2001; Harrison et al. 2006). Other variables include weak organizational identification (Rosse and Miller 1988); lack of fit (Rosse 1988); pay inequity, poor performance review, lack of promotion, and other justice violations (Hanisch 1995; Burton et al. 2010); work-related stress (Becker and Martin 1995; Hanisch 1995; Krausz et al. 1995); and reaching an occupational plateau (Elsass and Ralston 1989).

Some of these studies suggest that several withdrawal cognitions and behaviors may occur simultaneously or even lead sequentially from less extreme to more extreme cases, as one is forced to find new ways to cope with unsatisfying situations and/or

receives positive feedback (Gupta and Jenkins 1982, 1991; Clegg 1983; Rosse and Miller 1984; Rosse and Hulin 1985; Rosse 1988; Mitra et al. 1992; Becker and Martin 1995; Krausz et al. 1995; Koslowsky et al. 1997; Blau 1998; Hanisch et al. 1998; Morrow et al. 1999; Koslowsky 2000; Hom and Kinicki 2001; Harrison et al. 2006). It seems possible that voluntary occupational turnover may be the most drastic of these related withdrawal cognitions and behaviors (Elsass and Roulston 1989; Carson et al. 1995, 1996; Krausz et al. 1995; Carson and Carson 1997), but voluntary occupational turnover is understudied compared to the more visible and expensive behaviors of lateness, absenteeism, and organizational turnover (Hanisch et al. 1988). Nevertheless, it seems important to know that, even if an individual does not go so far as to leave an occupation, they may still be motivated by their experiences to engage in other detrimental withdrawal cognitions and behaviors.

(iv) Summary

Voluntary occupational turnover exacts a variety of mental, financial, and social costs on leavers and can harm their employers and occupations through the loss of valuable workers. Turnover is often motivated by negative experiences related to working in an occupation. Thus, turnover researchers in many disciplines are concerned with ensuring the well-being of leavers and improving working conditions, and they have explored voluntary occupational turnover from several perspectives to gain a greater understanding of the process.

4) THE PROBLEM OF STUDYING VOLUNTARY OCCUPATIONAL TURNOVER

> With thousands of published studies of 'voluntary turnover' (quitting), it may seem incongruous to argue that, in fact, still little is known about why people quit. Yet the roles of perceived desirability of movement (often represented as

> job satisfaction) and ease of movement (often represented as unemployment rate), which are the two dominant predictors in voluntary turnover research, remain problematic in explaining quitting behavior. (Lee et al. 2008, p. 651)

(i) Turnover variable problems

As the above quote reveals, despite decades of research, understanding of voluntary occupational turnover is incomplete. The sheer number of turnover variables, only the most popular of which were described in the previous sub-section, is arguably the most significant inhibitor. For example, in their meta-analysis, Griffeth et al. (2000) identified 500 correlates used just throughout the 1990s! Unsurprisingly, no single study has been able to take into account all turnover variables. Furthermore, Russell (2013) criticized "excessive exuberance" (p. 158) with new turnover variables for preoccupying about a decade of turnover research at a time. He noted that the addition of new variables has failed to enhance the predictive validity of voluntary turnover. It has instead complicated conceptions of the turnover process, which obscures understanding of voluntary turnover and prevents managers from applying research findings to control voluntary turnover in their organizations and occupations.

Quite a few definitional problems compound the issue of too many turnover variables. First, popular turnover variables are frequently operationalized but rarely defined. For example, work-related satisfaction is one of the most popular variables, but researchers infrequently define it (Cotton and Tuttle 1986; Rosse 1991; Hom and Griffeth 1995; Spector 1997; Griffeth et al. 2000; Trevor 2001; Holtom et al. 2008). Brayfield and Crockett (1955) exemplify this omission even in early turnover research:

> We have not attempted to define such terms as job satisfaction or morale. Instead, we have found it necessary to assume that the measuring operations

> define the variables involved. Definitions are conspicuous by their absence in most current work in this area. (p. 397)

Omission of definitions has not improved much in the following decades. Although Locke (1976) and Spector (1997) later defined job satisfaction as an attitude stemming from the extent to which people like or dislike their jobs, only a handful of voluntary turnover studies have cited these definitions (e.g., Allen et al. 2003; Harrison et al. 2006; Carless and Bernath 2007). Second, besides ignoring actual definitions, researchers frequently ignore definitional trends. In reviewing over 7,000 studies that utilized job satisfaction, Spector (1997) noted that researchers after the 1970s abandoned references to need fulfillment as a component of satisfaction and instead doubled-down on satisfaction as an attitude. However, references to need fulfillment can still be found in post-1970s turnover research, such as Carson et al.'s (1995) definition of career satisfaction as "dealing with contentment, enjoyment, and fulfillment" (p. 303). Third, even single researchers have fallen prey to inconsistent definitions. For example, Carson et al. (1996) soon after defined career satisfaction alternatively as "enjoyment with one's line of work" (p. 280), while Carson and Carson (1997) defined career satisfaction as "contentment with career progress and prospects" (p. 69). Fourth, researchers operationalize the same turnover variables with different survey instruments. For example, Wallace (1993) identified eight occupational commitment scales in her meta-analysis of 25 commitment studies; Lee et al. (2000) identified seven commitments scales in 77 studies; and Spector (1997) identified twelve popular satisfaction scales. Finally, there is considerable overlap across some turnover variables. For example, Blau (1985a, 1988) originally defined occupational

commitment as one's attitude toward their occupation, which is so broadly affective as to have considerable overlap with satisfaction. Meyer et al. (1993) defined affective occupational commitment as one's emotional attachment to their occupation, and Tett and Meyer (1993) similarly defined job satisfaction as "one's affective attachment" (p. 261) to the entirety of their job or aspects of it. Given these similar definitions, it is not surprising that measures of satisfaction and commitment have been shown to correlate substantially and share a large amount of variance (Aryee and Tan 1992; Tett and Meyer 1993; Meyer et al. 2002; Blau 2007; Harrison et al. 2006). Harrison et al. (2006) recommend combining these two popularly utilized variables into one to eliminate overlap. While this type of action is theoretically supported, it would complicate evaluating the results of new studies against older studies!

Beyond these definitional issues, understanding of voluntary turnover also is hindered by: the failure to integrate turnover variables with the motivating forces behind them, which prevents understanding why empirical relationships occur (Maertz and Campion 2004; Maertz and Griffeth 2004); low base rates of turnover (Miller et al. 1979; Hom and Griffeth 1995; Hanisch et al. 1998); the inability of general attitudinal measures to predict specific cognitions and behaviors (Fischer 1980; Rushton et al. 1983; Hanisch and Hulin 1990, 1991; Roznowski and Hanisch 1990; Gupta and Jenkins 1991; Blau 1998; Hanisch et al. 1998; Rosse and Miller 2000); the inherently complex nature of voluntary turnover and the presence of unknown factors; and the common use of cross-sectional rather than longitudinal study designs (Rhodes and Doering 1983, 1993; Oleski and Subich 1996; de Croon et al. 2004; Carless and Arnup 2011).

Given these many issues, it is perhaps unsurprising that collective results paint a mixed picture of voluntary occupational turnover. This lack of clarity is exemplified best by inconsistent findings regarding satisfaction. While work-related dissatisfaction has emerged as one of the strongest factors related to voluntary occupational turnover in some studies (Neapolitan 1980; Herrick et al. 1983; Teixeira and Gomes 2000; Luzius and Ard 2006; Blau 2007), it has not related significantly to turnover in other studies (Cabral et al. 1985; Breeden 1993; Higgins 2001; Carless and Arnup 2011; Hwang et al. 2011; McGinley et al. 2014). In many cases, leavers were to some extent satisfied with the occupations they were leaving (Hiestand 1971; Herrick et al. 1983; Roborgh and Stacey 1987; Cherniss 1989; Serow and Forrest 1994; Rathbun-Grubb 2009; Sian 2013; Howes and Goodman-Delahunty 2014; McGinley et al. 2014; Brown et al. 2015; Kesse 2015; Way 2015; Ahn 2016)!

In particular, dissatisfaction with extrinsic rewards has been a sticking point. Although dissatisfaction with extrinsic rewards frequently has been posited as a major factor in voluntary turnover (Cotton and Tuttle 1986; Hom and Griffeth 1995; Griffeth et al. 2000), it has not correlated significantly with voluntary occupational turnover or been reported by leavers in many of the studies listed above. Instead, much research indicates that satisfaction with extrinsic rewards appears to be a larger factor for occupational stayers than leavers (Neapolitan 1980; Kanchier and Unruh 1989; Cherniss 1989; Harper 1995; Whitebook and Sakai 2003; Parrado et al. 2007; Rathbun-Grubb 2009; Witchger 2011; Brown et al. 2015). What is more, several studies have found that leavers experience, and may even expect, a decrease in salary after an occupation change, and they may earn less over time than stayers, possibly due to the lack of skills

and experience specific to their new occupations (Neapolitan 1980; Roborgh and Stacey 1987; Fisher 1988; Serow and Forrest 1994; Wise and Millward 2005; Feldman and Ng 2007; Parrado et al. 2007; Ahn 2016; Wong et al. 2016). However, labor market studies find better pay to be the strongest correlate with occupation change (Rytina 1982; Markey and Parks 1989), and some studies have found that occupational leavers earn more over time than stayers (Wilson and Green 1990; Whitebook and Sakai 2003; Rathbun-Grubb 2009).

The problem of the consistent but fairly weak relationship between satisfaction and voluntary turnover is well recognized by turnover researchers (Hulin et al. 1985; Hom et al. 1992; Lee and Mitchell 1994; Lee and Mitchell 1996, 1999, 2008; Hom and Griffeth 1995; Griffeth et al. 2000; Mitchell and Lee 2001; Maertz and Campion 2004; Holtom et al. 2008). Several researchers have forwarded reasons that satisfaction shows such weak relationships with turnover, such as: the inability of general attitudinal measures to predict specific behaviors; the occurrence of a jarring event or implementation of a plan that initiates consideration of quitting regardless of satisfaction (Lee and Mitchell 1994; Lee et al. 1996, 1999, 2008; Mitchell and Lee 2001; Morrell et al. 2004a); attraction to another occupation without dissatisfaction with the first occupation (Maertz and Campion 2004); the roles of education and the job market in allowing an individual to translate dissatisfaction into actual leaving (Hulin et al. 1985; Trevor 2001); and the present-oriented nature of satisfaction that may cover up the future-oriented nature of turnover decision-making (Krantz 1977; Neapolitan 1980; Maertz and Campion 2004; Maertz and Griffeth 2004; Wise and Millward 2005; Murtagh et al. 2011; Howes and Goodman-Delahunty 2014; McGinley et al. 2014).

Despite these shortcomings, satisfaction and other general attitudes like commitment remain the most popular turnover variables, and this issue remains unresolved.

(ii) Voluntary employee turnover model problems

To account for the modest relationships between even popular variables and voluntary turnover, boost predictive validity, and better understand the psychology of voluntary turnover, researchers have constructed models to sequence variables and trace out the voluntary turnover process. Historically, researchers studying voluntary employee turnover (i.e., job quits) have led the way in developing models. March and Simon's (1958) seminal voluntary employee turnover model conceptualizes turnover as resulting from imbalance between an employee's expectations about rewards and the actual rewards provided by their employers for their efforts. March and Simon (1958) operationalized voluntary employee turnover as a function of both an individual's perception of the desirability of their current job and their perception of ease of movement to other job opportunities. In the decades since its publication, "perceived job desirability" became synonymous with "job satisfaction" and "perceived ease of movement" became synonymous with "perceived availability of alternative opportunities" in psychological studies and "unemployment rate" in labor market studies (Hulin et al. 1985; Lee et al. 1994; Lee et al. 1996; Mitchell and Lee 2001; Trevor 2001; Griffeth et al. 2005; Holtom et al. 2008; Lee et al. 2008; Hom et al. 2012).

March and Simon's (1958) modified constructs propagated through subsequent employee turnover models. From the late 1970s through the early 1990s, "intermediate linkages" models dominated research (Price 1977; Mobley 1977; Mobley et al. 1978; Price and Mueller 1981; Steers and Mowday 1981; Bluedorn 1982; Hom et al. 1984,

1992; Hulin et al. 1985; Dalessio et al. 1986; Bannister and Griffeth 1986; Hom and Griffeth 1991). These models linked job satisfaction indirectly to voluntary employee turnover through small causal steps to help illustrate the psychology of turnover. According to these models, the turnover process begins with evaluation of one's job that results in job dissatisfaction. Job dissatisfaction leads to withdrawal cognitions such as intention to search for other jobs, thoughts of quitting, or intention to quit. Withdrawal cognitions lead to activities such as job search and evaluation of alternative employment opportunities. These activities finally lead to actual voluntary employee turnover.

Tests of the intermediate linkages models gave them general support but tended to find moderate relationships at best between any given steps. Tests performed with different samples also indicated slightly different pathways to voluntary employee turnover, and this led researchers propose many new models with only slight modifications (Mobley et al. 1978; Miller et al. 1979; Coverdale and Terborg 1980; Spencer et al. 1981; Bluedorn 1982; Arnold and Feldman 1982; Michaels and Spector 1982; Youngblood et al. 1983; Motowidlo and Lawton 1984; Stumpf and Hartman 1984; Hom et al. 1984; Mowday et al. 1984; Dalessio et al. 1986; Bannister and Griffeth 1986; Lee and Mowday 1987; Griffeth and Hom 1988; Lee 1988; Hom and Griffeth 1991). Besides complicating conceptions of voluntary employee turnover, each model was too extensive to easily test in full, yet each also failed to include even popular turnover variables, and they were inherently hampered by the definitional issues discussed in the previous sub-section (Mobley et al. 1978; Miller et al. 1979; Coverdale and Terborg 1980; Spencer et al. 1981; Arnold and Feldman 1982; Michaels and Spector 1982; Youngblood et al. 1983; Motowidlo and Lawton 1984; Mowday et al.

1984; Stumpf and Hartman 1984; Bannister and Griffeth 1986; Griffeth and Hom 1988). By the 2000s, Hom and Kinicki (2001) noted that turnover researchers had "become disenchanted with this inquiry, given the modest predictive validity of these models" (p. 975). Nevertheless, the influence of intermediate linkages models is apparent in voluntary turnover studies even decades later (e.g., Lee et al. 2008; Hom et al. 2012).

Besides their complexity, another major shortcoming of intermediate linkages models is that they pay only lip service to non-affective motivators of voluntary employee turnover. For example, Mobley (1977) included a direct path from "impulsive" (i.e., non-rational) behavior to voluntary employee turnover, but this path was never studied. Similarly, Steers and Mowday's (1981) path from "non-work factors" to intent to leave, such as dual career considerations or time for family, was studied only once (Lee and Mowday 1987).

In the decades since the heyday of intermediate linkage models, researchers have embraced the ability of non-affective factors such as family responsibilities, unsolicited job offers, or the discovery of new interests to explain many cases of voluntary turnover. The unfolding model of voluntary employee turnover (Lee and Mitchell 1994; Lee et al. 1999) best exemplifies this trend. The unfolding model is built upon the idea that different individuals choose to leave their employers in different ways. It specifies five paths to voluntary employee turnover, only two of which trace out steps similar to the intermediate linkages models. The three remaining paths are driven by "shocks," which are non-affective, jarring events that initiate psychological analysis of quitting. Shocks do not lead directly to turnover, but they "get the ball

rolling" for the turnover process by giving a worker new information about or meanings for their work. Shocks can be positive, negative, or neutral; expected or unexpected; and they can originate internally or externally to an employing organization. Examples of shocks include: unsolicited job offers; changes in marital state; becoming pregnant; being transferred or having a partner transferred; firm merger; downsizing; being promoted or failing to obtain a promotion; completion of professional development or training; organizational changes; justice violations; receiving a negative performance evaluation; experiencing unexpected working conditions; being asked to do something that goes against one's beliefs; and clashing with co-workers or supervisors (Lee et al. 1999; Mitchell et al. 2001b; Morrell et al. 2004ab; Holtom et al. 2005; Allen et al. 2010).

Several tests of the unfolding model indicate that it describes many more instances of voluntary employee turnover than do intermediate linkages models (Lee et al. 1996, 1999; Donnelly and Quirin 2006; Morrell et al. 2008; Burton et al. 2010), and related studies indicate that shocks are more influential than dissatisfaction in many or even most cases (Maertz and Campion 2004; Morrell et al. 2004ab; Holtom et al. 2005, 2008; Kammeyer-Mueller et al. 2005; Holt et al. 2007; Niederman et al. 2007; Lee et al. 2008; Jones et al. 2010; Hom et al. 2012; Siebert et al. 2013). Thus, the literature surrounding the unfolding model suggests that the pervasiveness of shocks and absence of dissatisfaction may account for the only moderate predictive validity of intermediate linkage models.

Unfortunately, the unfolding model does not appear to completely capture voluntary employee turnover. Other tests of the unfolding model that sampled leavers

from different occupational groups failed to classify the majority of leavers into the five original paths, and they had to add more paths to boost validity (Holt et al. 2007; Niederman et al. 2007; Jones et al. 2010). In the latest incarnation, Jones et al. (2010) specified 10 paths to turnover! Furthermore, Maertz and Campion (2004) identified preplanned, conditional, and impulsive quits in their study of motivations for voluntary turnover, which are not included in the unfolding model or any of its extensions.

A further shortcoming of most voluntary employee turnover models is that they value the objective side of the experience more than they value the subjective side (Stephens 1994; Higgins 2001). Objective aspects are visible to non-experiencing outsiders, such as poor performance, lateness, absenteeism, and job search. Subjective aspects take place in the minds of experiencing individuals: Creating meaning from work; weakening attachment to an employer or occupation; thinking about leaving; desiring to leave; intending to leave; evaluating alternatives; etc. Psychological studies of voluntary employee turnover have attempted to render subjective aspects visible through survey instruments that measure variables discussed above like satisfaction, commitment, involvement, and entrenchment. However, turnover variables are distanced from the motivating forces behind them, and this inhibits understanding their relevance to voluntary turnover (Maertz and Griffeth 2004; Maertz and Campion 2004).

(iv) Voluntary occupational turnover model problems

Voluntary occupational turnover research has lagged voluntary employee turnover research, and several researchers have based their occupational work on pre-existing employee work. For example, Meyer et al.'s (1993) three-dimensional occupational commitment followed from their previous work on three-dimensional

organizational commitment (Allen and Meyer 1990; Meyer and Allen 1991), and Ng and Feldman's (2007) occupational embeddedness followed from Mitchell et al.'s (2001b) job embeddedness. In drawing from voluntary turnover research, voluntary occupational turnover research has fallen prey to the same variable and model issues discussed above.

Rhodes and Doering's (1983) integrated model is the one published comprehensive model of voluntary occupational turnover, and it is the starkest example of how occupational turnover researchers have drawn from employee turnover research. The integrated model is based on Price (1977), Mobley (1977), and Steers and Mowday's (1981) intermediate linkages models. As with those models, satisfaction—especially job satisfaction—is centralized in the turnover process, and the occupational turnover process ends with withdrawal cognitions, search and evaluation activities, and change in occupations. Additionally, non-affective "other factors" besides dissatisfaction, such as fear of lay-off or dual career considerations, are given only passing acknowledgement.

The integrated model has been tested only a few times: never in full (Cabral et al. 1985; Blau 1989, 2007; Carless and Arnup 2011), and twice ending with intention to turnover rather than actual turnover (Rhodes and Doering 1993; Carless and Bernath 2007). As with tests of the intermediate linkages models, the integrated model has received mixed support. Several researchers also have lodged specific complaints against the integrated model: Blau (2007) suggested that newer research on work exhaustion be added. McGinley et al. (2014) criticized the model for ignoring non-affective antecedents to turnover as well as retention forces that might prevent or

complicate turnover, and for ignoring the importance of future-oriented thinking. Way (2015) criticized the model for failing to expand upon gender-related issues, and Fouad et al. (2016) called for the addition of organizational factors like micro-aggressions and workplace social support.

Additionally, the integrated model has not been updated to include newer employee turnover research on non-affective pathways to turnover, such as shocks. The concept of shocks originated in the voluntary employee turnover literature associated with the unfolding model. Although shocks have not been extended formally into the voluntary occupational turnover literature, several studies have found that events similar to shocks (called "serendipitous career development events," "moment of crisis," "turning point," "unplanned events," "rupturing incidents," and "critical events") can instigate voluntary occupational turnover (Betsworth and Hansen 1996; Teixeira and Gomes 2000; Witchger 2011; Howes and Goodman-Delahunty 2014; Ahn 2016). The integrated model also ignores newer research that highlights the important role of a diverse network of social advisors in supporting and motivating thoughts of occupation change and providing opportunities to change through job offers (Doering and Rhodes 1989; Higgins 2001; Motulsky 2010).

Despite these shortcomings, the integrated model is the only comprehensive model of voluntary occupational turnover, and consequently, it has dominated voluntary occupational turnover research for decades. It remains popular to the present day, and is still utilized in recent turnover studies to explain aspects of voluntary occupational turnover (Higgins 2001; Rathbun-Grubb 2009; Carless and Arnup 2011; Kesse 2015; Way 2015; Ahn 2016; Fouad et al. 2016).

(iv) Other problems

Studies of both voluntary occupational leavers and stayers have found that they are not necessarily different in terms of work-related attitudes and experiences (e.g., Krantz 1977; Neapolitan1980; Perosa and Perosa 1984; Cherniss 1989; Kanchier and Unruh 1989; Breeden 1993; Whitebook and Sakai 2003; Witchger 2011; Brown et al. 2015; Fouad et al. 2016). As Krantz (1977) puts it, "The fundamental difference between those of us 'normals' who stay in the trajectory of our lives and careers and those who choose to change that direction is the solution chosen, not in the problems themselves" (p. 167). These studies as well as studies of only leavers (Hiestand 1971; Roborgh and Stacey 1987; Doering and Rhodes 1989; Teixeira and Gomes 2000; Wise and Millward 2005; Ahn 2016) generally agree that leavers have supports in place that help them exit, such as available opportunities in other occupations; financial support; a lack of dependents; encouragement from important others; and/or belief in their abilities to succeed in changing. Stayers, on the other hand, may feel that they lack supports and/or feel bound by security or aversion to risk. Nevertheless, the similarity of leavers and stayers prevents quantitative turnover studies, which sample both types of individuals, from having stronger predictive validity.

Furthermore, voluntary occupational leavers are difficult to locate for study (Blau 2000, 2007; Carless and Arnup 2011; Russell 2013). Leavers form a small population that is "rare and thinly dispersed among a larger population" (Welch 1975, p. 237), and this issue is compounded when one focuses on leavers from a single occupation. They often are hidden due to lapsed membership in professional organizations, or their former employers may not know that their quits were part of

occupational exits. Because voluntary occupational turnover is fairly rare compared to job quits, researchers who wish to avoid searching directly for leavers and instead use probability sampling would have to wait for years in order to allow for a sizable number of individuals in their samples to exit.

To circumvent this issue, many turnover researchers have chosen to substitute individuals who only intend to leave their occupations for actual occupation leavers (e.g., Blau 1985a, 1988, 2000; Aryee and Tan 1992; Meyer et al. 1993; Rhodes and Doering 1993; Aryee et al. 1994; Carson and Bedeian 1994; Carson et al. 1995, 1996; Krausz et al. 1995; Blau and Lunz 1998; Blau et al. 2003; Blau and Holladay 2006; Donohue 2006; Chang et al. 2007; Khapova et al. 2007; Carless and Bernath 2007; Duffy et al. 2011; Shropshire and Kadlec 2012; Laschinger and Fida 2013; Yousaf et al. 2015). Researchers justify this choice with the theories of reasoned action (Fishbein 1967; Fishbein and Ajzen 1975) and task motivation (Locke 1968), which posit that intentions directly precede actual behavior. Based on these theories, intention to leave has been included as a direct or proximal psychological precursor to actual voluntary turnover in intermediate linkages models of voluntary employee turnover and the integrated model of voluntary occupational turnover (Mobley 1977; Mobley et al. 1978; Price and Mueller 1981; Steers and Mowday 1981; Bluedorn 1982; Rhodes and Doering 1983; Hom et al. 1984, 1992; Mowday et al. 1984; Hulin et al. 1985; Dalessio et al. 1986; Bannister and Griffeth 1986; Hom and Griffeth 1991). As expected, intention to leave has a significant negative relationship with both types of voluntary turnover, and it often is the best predictor of voluntary turnover (Mobley et al. 1978, 1979; Price and Mueller 1981; Michaels and Spector 1982; Motowidlo and Lawton 1984; Steel and

Ovalle 1984; Mowday et al. 1984; Cotton and Tuttle 1986; Lee and Mowday 1987; Griffeth and Hom 1988; Blau 1989, 2007; Bedeian et al. 1991; Tett and Meyer 1993; Hom and Griffeth 1995; Irving et al. 1997; Griffeth et al. 2000, 2005; Mitchell et al. 2001b; Allen et al. 2005; Carless and Arnup 2011; Kesse 2015; Fouad et al. 2016).

Even though intention to leave is one of the best predictors of actual voluntary turnover, it is only moderately related to actual turnover and accounts for a small amount of variance. There are many reasons why one may leave an occupation without first intending to do so, such as due to receipt of an unsolicited job offer, movement to follow a partner, the development of health issues, the unexpected decision to take care of an ailing family member, etc. (Lee et al. 1999; Hom et al. 2012). Studies that test only for intention to leave would fail to capture these situations. An individual also may intend to leave but not act upon those intentions due to lack of available alternative employment, untenable costs, aversion to risk, change in emotion, or some other obstacle that they cannot control or overcome (Michaels and Spector 1982; Hulin et al. 1985; Hom et al. 1992; Ajzen and Fishbein 2005; Allen et al. 2005; Holtom et al. 2008; Hom et al. 2012). Carson and Carson (1997) note that surveys indicate that one in three workers would like to choose a new occupation, while census data indicate that only one in ten workers changes occupations each year. Furthermore, Waller and Mitchell (1991) demonstrated that imagining an event like voluntarily leaving an occupation is different than experiencing it, because unanticipated intervening events modify what actually happens despite an individual's intentions and/or because intervening events can modify an individual's affect toward the event and their intended actions. Thus, by missing unintended leavers and likely measuring some actual stayers, the practice of

substituting intended leavers as a proxy for actual leavers muddies understanding of occupational turnover, especially when the results of such studies are incorporated into reviews, studies, and models of voluntary turnover.

With so many factors that affect voluntary turnover to some degree; their impact on stayers as well as leavers; and the difficulty of locating actual leavers to study, it is not surprising that the majority of turnover variables described above correlate at best moderately with voluntary occupational turnover, and models have modest predictive validity. Thus, although studies have identified several fairly stable characteristics of occupation leavers and the process of voluntary occupational turnover, many questions remain, and turnover researchers have been unable to definitely answer why some workers change occupations despite decades of research.

b. Research purpose and significance of the study

The purpose of this study is to understand the roles played by occupational factors in voluntary exits from the atmospheric science occupation. Occupational factors rather than personal characteristics such as age and personality are chosen for focus so that the results can be of greater use to leaders in the field to identify areas for improvement and thereby maintain the health of the occupation.

To best fulfill this purpose, I propose to study of the experience of voluntarily exiting the atmospheric science occupation for individuals who have worked in it for some time. The qualifier "for individuals who have worked in it for some time" is added to avoid mixing the experience of voluntary occupational turnover with the experience of seeking but never finding work in the atmospheric science occupation, and the experience of choosing to not work in the occupation without ever having experienced

it. Additionally, only those who have worked in the occupation can describe the roles played by occupational factors in their voluntary exits.

As detailed in the previous sub-section, existing voluntary occupational turnover research has many shortcomings. In order to explicate the turnover experience for atmospheric scientists without imposing the questionable findings of previous studies, I propose to collect rich, detailed qualitative data through semi-structured interviews with degree-holding atmospheric scientists who self-reported that they voluntary left the occupation after working in it for some time. This approach also will reveal context specific to atmospheric scientists and thereby better inform future data collection, both quantitative and qualitative.

1) SIGNIFICANCE OF QUALITATIVE STUDIES TO OCCUPATIONAL TURNOVER RESEARCH

"[I]t was evident that historically the empirical investigations of a new career phenomenon was often initiated by studies with inductive qualitative approaches" (Sun and Wang 2011, p. 35).

Review of the studies cited above reveals that voluntary turnover research has been dominated by the use of survey instruments to quantify the relationships between economic, attitudinal, perceptual, and behavioral variables and voluntary exits. The bulk of such studies suggests that voluntary occupational turnover is a difficult, costly process that is often driven by an individual's experience with occupational factors that are in some way incompatible with their lives. Psychologists, sociologists, economists, and managers wish to understand these experiences in order to avoid these costs when

possible, and turnover researchers have pursued that end vigorously for over half a century.

Unfortunately, voluntary occupational turnover research continues to be plagued by the variety of issues described in the previous sub-section, and these issues prohibit understanding the experience of voluntary occupational turnover despite decades of work. Lack of understanding threatens the relevance of such work to managers or other leaders who wish to work to minimize costly turnover (Russell 2013). In my opinion, the four biggest issues that currently hold back understanding of voluntary occupational turnover are: (1) Voluntary turnover models have become increasingly complicated without a corresponding increase in their predictive validity; (2) voluntary occupational turnover research lags voluntary organizational turnover research and is dominated by a model based largely on outmoded work from the 1970s and 1980s; (3) occupational turnover researchers often substitute individuals who intend to leave for actual leavers, and subsequent studies group the results of these studies with studies of actual leavers without differentiating between them; and (4) the dominant usage of turnover variables divorces turnover models from the subjective, lived experience of voluntary turnover. Many voluntary occupational turnover researchers share similar concerns (Thomas 1980; Blau 1989, 2007; Cherniss 1989; Teixeira and Gomes 2000; Wise and Millward 2005; Carless and Arnup 2011; McGinley et al. 2014), but questionable variables, model components, and practices continue to propagate through current research. Additionally, most of the methodologies as described by the authors of the above studies did not include opportunities for the researchers to confer with their participants to gain further details about their turnover experiences. This prevents them from both

clarifying confusing responses and connecting turnover variables to narratives of the participants' exits to better understand how they relate to the lived experience of voluntary turnover.

Incorporating perspectives that encourage non-traditional methodologies could revitalize voluntary occupational turnover research. Especially in the last couple of decades, career research as a whole has been reinvigorated by the spread of epistemological and theoretical perspectives that value individuals' descriptions of subjective aspects of career (Brown et al. 2005; Savickas 2011, 2012; McMahon 2014; Patton and McMahon 2014). Such perspectives lend themselves to qualitative research designs, which typically employ semi-structured interviews or written narratives to enable individuals to describe their experiences holistically and meaningfully, with relatively minimal imposition of the researcher's hypotheses and theories. The use of qualitative research designs disrupts the norm of quantitative approaches in scientific research while better capturing the subjective side of career.

Qualitative research designs are useful when existing theories are inadequate (Creswell 2012), and they have great promise for revitalizing turnover research. Researchers are increasingly acknowledging the importance of understanding the subjective side of voluntary occupational turnover, and after a lull in the 1990s, many have implemented qualitative approaches to investigate occupational exit decisions through analysis of experiencing individuals' accounts (Hiestand 1971; Krantz 1977; Osherson 1980; Neapolitan 1980; Thomas 1980; Cherniss 1989; Chusid and Cochran 1989; Kanchier and Unruh 1989; Teixeira and Gomes 2000; Wise and Millward 2005; Amundson et al. 2010; Motulsky 2010; Murtagh et al. 2011; Howes and Goodman-

Delahunty 2014; McGinley et al. 2014; Ahn 2016). By giving attention to the subjective side of turnover, these studies have captured new aspects of voluntary occupational turnover: the importance of connecting with others; the desire for work to allow for meaningful non-work experiences; the "planless" nature of exits; and the creation of temporal continuity to make sense of turnover. They also have been able to contextualize exits; identify sources of weakness in traditional turnover studies like those discussed in the previous sub-section; uncover aspects of the turnover experience that are hidden by close-ended questions, rating scales, and other survey instruments; and provide much greater depth of understanding of what it is like to experience leaving.

In particular, several researchers have used phenomenological research designs to uncover and clarify psychological aspects of voluntary occupational turnover. The current study is phenomenological, and its research design will be detailed in Sec. 2. Briefly, phenomenological approaches are used to reveal the general structure of a lived experience for an experiencing individual. The researcher intuits the structure with the aid of rich descriptions given by a variety of individuals who have had the experience of interest. The culmination of a phenomenological study is a description of the general structure. Even compared with other qualitative approaches, phenomenological approaches enable inquiry that is especially free from researcher pre-conceptions and open to participants' descriptions. The designs and findings of several phenomenological investigations of voluntary occupational turnover are summarized below.

- Teixeira and Gomes (2000) conducted a descriptive phenomenological study to understand the experience of voluntary occupation change. They gathered descriptions through one to two-and-a-half hour semi-structured interviews with seven participants who had voluntarily left one occupation to obtain advanced training and employment in another occupation. They characterized the general structure of the experience of voluntary occupation change for leavers as "a broad process of change in the relationship between the subjects and their work" (Teixeira and Gomes 2000, p. 90), and they specified that this process "begins with the awareness of feelings of dissatisfaction with the career, leading the subjects to ask questions of themselves and what they do" (p. 90). For some participants, dissatisfaction stemmed from frustrations related to working in an occupation that was chosen half-heartedly out of obligation to social norms but was incompatible with personal interests. For others, dissatisfaction came from work requirements that interfered with their personal creativity or private lives. Leavers viewed such constraints as rigid and inhibiting self-determination, and they were only able to alleviate them by leaving their occupations. Like many other turnover studies have found, loss of money and status, with corresponding feelings of guilt and uselessness, complicated the exit decision. The authors also identified a rather unstudied complicating factor: Leavers may temporarily persist in an unwanted occupation by redefining their suffering as a test of values to overcome. This is similar to Neapolitan's (1980) finding that early challenges in the original occupation can delay exiting it.

- Wise and Millward (2005) conducted an interpretive phenomenological study to understand the experience of voluntary occupation change for 30-somethings. Specifically, they wished to identify the key psychological issues involved in the change process. They gathered descriptions through one-and-a-half to two hour semi-structured interviews with 10 participants who had voluntarily changed occupations. They found that occupation change was "to some degree a response to wanting their job to fit their personal requirements" (Wise and Millward 2005, p. 409). Leavers required that their work aligned with personal values: Their values were more influential in driving their career development than extrinsic rewards, and they wished to integrate personal and work lives into a meaningful whole. Leavers also required temporal continuity: In actively constructing their career narratives, they sought to create continuity to make sense of their transitions, despite the discontinuity brought about by occupation change. This could involve finding ways to extend skills, interests, and experience from the old occupation into the new occupation. It also could involve obtaining achievement and recognition in, and building identification with, the new occupation. Temporary discontinuity was also important. Like Cherniss (1989) found in his biographical interviews with leavers, Wise and Millward (2005) found that a moratorium from usual pressures was essential for deciding upon the change and lowering stress in the transition.
- Murtagh et al. (2011) conducted an interpretive phenomenological study to understand the psychological process of deciding to voluntary change occupations. They gathered descriptions through two one-hour semi-structured interviews with eight participants who had voluntarily changed occupations within the previous

three years. They found that, instead of being led by cold rationality, leavers were led by satisfaction and enjoyment with work in new occupations. Such positive emotions could stem from intentionally-sought experience in a new occupation, or they could stem from "planless" actions that the leaver engaged in without looking for a new occupation. Positive emotions were both present-oriented in experiencing the new occupation, and future-oriented in anticipating further benefits in the new occupation. Negative future-oriented emotions, such as imagined regret over staying in the first unwanted occupation rather than changing to the second, more desired occupation, also led the change decision. Leavers used these emotions to create certainty in their decisions, without searching for other occupational opportunities, by framing choices as natural, obvious, inevitable, and "right." Thus, leavers subjectively constructed continuity in their work histories despite objective discontinuities.

- Way (2015) conducted an interpretive phenomenological study to understand the experience for women of leaving the information technology (IT) occupation. She conducted half-hour to hour-and-a-half semi-structured interviews with 10 women who had voluntary left the IT occupation, either for work in another occupation or to exit the workforce altogether. She found that negative experiences related to occupational culture, organizational climate, work-family balance, and bias and discrimination motivated exits. Her findings added gender-related nuances to issues of dissatisfaction with workplace culture, conflict with supervisors and co-workers, work-life conflict, and lack of promotion opportunities. For example, women were held to a higher standard of behavior than their male co-workers, and they were

passed over for promotion and questioned by their supervisors about their plans to have children. Additionally, leavers desired more meaningful work than the IT occupation could provide, such as work that could positively impact the world. Even more so than in Murtagh et al.'s (2011) study, Way (2015) found that leavers did not necessarily search for new occupations or otherwise prepare for their exits.

- Ahn (2016) conducted an interpretive phenomenological study to understand the relationship between a sense of calling and voluntary occupation change. To this end, she conducted one to one-and-a-half hour semi-structured interviews eight voluntary occupation changers who also had perceived a related sense of calling. A calling provided leavers with better understandings of themselves and abilities to make meanings out of experiences. Recognizing a better fitting occupation was just one benefit of following a calling: Leavers also expanded their self-worth and better aligned their personal values with work life. They found these changes to be more fulfilling than gaining extrinsic rewards. Answering a calling outweighed painful cost barriers to change. Like Murtagh et al. (2011), Ahn (2016) found that strong emotions led leavers above and beyond cold rationality, and they built certainty in the "rightness" of their decisions to help cope with transitional challenges. Like Way (2015), she found that participants' satisfaction with their work in their previous occupations was high, despite lack of enjoyment or fulfillment. She offered two reasons why this might be the case: First, leavers were more satisfied with their new occupations and, therefore, with life in general, and this motivated them to reflect positively on their previous occupations. More significantly, leavers considered their past work as meaningful and necessary to bring them to their

current occupations: Their previous work gave them skills that smoothed their transitions, and it also provided gave them the opportunity to determine why they were unfulfilled and thereby discover their callings.

All of these studies, along with other qualitative studies of voluntary occupational turnover, reveal that turnover is largely driven by intrinsic rather than extrinsic rewards, such as the desire to align work with personal values, take on meaningful work, and integrate work with personal and family lives. Their descriptions of the complex and personal nature of voluntary turnover suggest why many quantitative studies fail to find strong or predictive relationships between affective measures like satisfaction and leaving. Significantly, all of the above phenomenological studies, as well as other qualitative studies (Krantz 1977; Neapolitan 1980; McGinley et al. 2014) noted that turnover was guided by future-oriented thinking. Present-oriented emotions such as satisfaction could alert workers of an occupation-related issue, but thoughts of the future guided their exits. The influence of future-oriented thinking contrasts markedly with the present-oriented nature of satisfaction, lack of fit, and other popular turnover variables discussed in the previous sub-section, and suggests another reason why relationships between turnover variables and actual turnover are much weaker than expected. Additionally, several of the phenomenological studies, as well other qualitative studies noted in the previous sub-section, found that unexpected events that spring from diverse areas of life may instigate voluntary occupational turnover.

Overall, the findings of qualitative voluntary occupational turnover studies—especially those that use phenomenological research designs—speak to the variety and complexity of turnover. This same complexity is apparent in the vast

voluntary turnover models based upon quantitative studies. But, the power of qualitative research designs is that they enable researchers to search out the broad structures of the experience of voluntary occupational turnover that allow for many factors, without getting bogged down in a never-ending supply of turnover variables.

Different research approaches are able to illuminate different facets of a topic of interest. For example, quantitative studies have highlighted the importance of incompatibility and unexpected events to voluntary occupational turnover, but research in those veins seems to be stalled. Many career researchers, including some turnover researchers, have recognized the value of using qualitative approaches that give experiencing individuals voice to gain deeper understanding of established topics, address confusing or contradictory findings, and uncover new facets (Cherniss 1989; Spokane et al. 2000; Blustein 2001, 2011a; Phillips et al. 2001; Schultheiss et al. 2001; Lent et al. 2002; Blustein et al. 2004; Wise an Millward 2005; Felps et al. 2009; Carless and Arnup 2011; Sun and Wang 2011; Stead et al. 2012; McGinley et al. 2014). A qualitative study on atmospheric science leavers would answer calls from career scholars to increase the use of qualitative approaches to better elucidate lived experiences, such as the experience of voluntary occupational turnover (Herr 1997; Lent et al. 2000; Spokane et al. 2000; Subich 2001; Walsh 2001; Savickas 2001a; Blustein 2001, 2011ab; Schultheiss et al. 2001; Maertz and Griffeth 2004; Holtom et al. 2008; Stead et al. 2012; McMahon 2014).

2) SIGNIFICANCE OF STUDYING VOLUNTARY OCCUPATIONAL TURNOVER TO ATMOSPHERIC SCIENCE

"In a Golden Age, the Golden Rule must apply: the leaders in meteorology must care for their students as they expect their own sons and daughters to be cared for by the leaders of their chosen professions" (Knox 2008, p. 882).

A study on voluntary atmospheric science leavers would begin to answer Mass (1996) and Knox's (2008) calls for honesty about the employment of atmospheric scientists. As discussed above, qualitative studies show much promise to address the shortcomings of traditional quantitative studies of voluntary occupational turnover while holistically describing the exit experience. Accordingly, I recommend that revitalization and progress in the study of atmospheric scientists' employment also come from qualitative studies. Although I heartily wish that Mass (1996) and Knox's (2008) calls to create comprehensive employment databases are answered, if quantitative data collection on atmospheric scientists resumed at this minute, it is likely that questions and choices would be based on the pre-conceptions of those designing the survey rather than on accounts given by a variety of atmospheric scientists. Qualitative data is necessary to understand what it is like for atmospheric scientists to work in the occupation, and it can inform and improve subsequent quantitative data collection.

I particularly wish to illuminate the roles played by occupational factors in voluntary exits from the atmospheric science occupation. For one, avoidable or dysfunctional voluntary occupational turnover can point out areas for improvement. Furthermore, existing turnover research strongly indicates that stayers are affected by the same occupational factors that motivate leavers, and these factors can lead to reduced commitment and cognitions and behaviors that harm workers, their employers, and their occupations as a whole. In order to ensure the continued productivity,

innovation, and health of the atmospheric science occupation, researchers, educators, employers, and other leaders in the field must have access to rich qualitative data that provides a holistic view of voluntary occupational turnover. Then, systematic quantitative data collection can proceed from reports of actual turnover experiences.

It is essential that study of voluntary turnover from the atmospheric science occupation comes from within the occupation itself, rather than rely solely on the findings of turnover work that used mixed samples of leavers or leavers from other specific occupations, in order to capture relevant context. As Mowday et al. (1984), Rosenfeld (1992), Lee and Maurer (1997) Lee et al. (1999), Trevor (2001), Harman et al. (2007), Holtom et al. (2008), Allen et al. (2010), Carless and Arnup (2011), and Fouad et al. (2016) have pointed out explicitly, and many other turnover studies imply, different occupations experience different patterns of turnover due to varied contextual factors, and "the psychology of voluntary turnover may mean very different things at different kinds of organizations" (Holtom et al. 2008, p. 264). Similarly, Thomas (1980) and Cherniss (1989) noted that a potential failing of many occupational turnover studies are that they lump together individuals who have exited different occupations, when in fact the contextual factors that influence change may be very different from occupation to occupation and may be smoothed out by grouping. Finally, Lee and Maurer (1997) pointed out that turnover research may not provide useful guidance if it does not capture context. Thus, performing a study with atmospheric science leavers would provide valuable context while also adding to the small body of studies that sample actual leavers, and a qualitative research design is particularly well-suited for investigations where context is important (Creswell 2012).

The majority of surveyed atmospheric scientists report being driven to pursue the occupation by childhood curiosity and weather-related experiences (Michaels et al. 2001; Murillo et al. 2008). They invest time, money, and mental energy to complete rigorous university coursework to earn their degrees (AMS 2010; OPM 2017) and find work in an occupation where entry-level jobs have recently been lacking (Knox 2008). As discussed above, such investments are consistently seen as promoting occupational retention. However, the little available employment data suggest that a perhaps sizable number of degree-holding atmospheric scientists are working outside of the occupation. In cases where atmospheric scientists voluntarily chose to leave, it seems likely that strong influences overcame retention forces and exacted painful costs on leavers and their former employers. In order for concerned atmospheric scientists to work towards the continued health and improvement of the occupation, it is essential to understand how those forces are related to working in the atmospheric science occupation. It is my goal to provide a strong base through this exploratory study so that further research into the occupation can proceed.

c. Research questions

"If one asks a quantitative question, then one should use a quantitative method; if one asks a qualitative question, then one should use a qualitative method" (Giorgi 2009, p. 5).

As will be discussed in detail in Sec. 2, the theoretical perspective of phenomenology guides this study, and a descriptive phenomenological approach that stems directly from this philosophy shapes the research design. Phenomenologists seek to understand what particular lived experiences are like by appealing to consciousness

as the core source of knowledge. They search for the "essences" of an experience, which are invariant, necessary aspects of a particular type of experience that are available to all who consciously experience it. To carry these goals from philosophical into scientific settings, phenomenological researchers ask broad research questions to avoid covering up aspects of an experience through interpretation via their own hypotheses, theories, and pre-knowledge. For any given experience, they seek to understand: What is it like? How does it happen? (Giorgi 2009; Englander 2012; Creswell 2012; van Manen 2014). The answer to the first question illuminates the meaning of an experience for an experiencing individual, and the answer to the second question provides the context that makes an experience possible. Together, these answers make up the general description of the structure of the experience of interest, which is the culmination of phenomenological studies.

Consistent with the language of phenomenology, the main research questions that guide this study are: What is it like to voluntarily exit the atmospheric science occupation? How does voluntarily exiting the atmospheric science occupation come about? The answer to the first question will illuminate the meaning of voluntarily exiting the occupation for a leaver, and the answer to the second question will provide contextual details about how the experience of voluntarily exiting the atmospheric science occupation becomes possible for a leaver. Additionally, answers to the second question may reveal the roles played by occupational factors in voluntary exits.

Additionally, it would be useful for leaders in the field to know how atmospheric science leavers evaluate their exits and if they seek to return to the occupation. To this end, I also ask: How do voluntary atmospheric science leavers

evaluate the avoidability of their exits? Would leavers return to the occupation? If so, under what conditions? If not, why? These questions are not phenomenological, as phenomenologists seek rich descriptions of a lived experience, without adding to it or subtracting from it with opinions or evaluations of hypothetical situations (Giorgi 2009). However, identification of such factors will highlight opportunities for growth or improvement, and as such they are important additional questions.

2. Research design

"[O]ur analysis and interpretation—our study's findings—will reflect the constructs, concepts, language, models, and theories that structured the study in the first place" (Merriam 1998, p. 48).

In order to fulfill the purpose of understanding the roles occupational factors play in voluntary exits from the atmospheric science occupation, the design of this study must elicit rich descriptions from participants who have lived through that experience. Since the experience of voluntary occupational turnover has not been studied specifically for atmospheric science, and needs clarification in general as discussed in Sec. 1, the research design must facilitate openness to the participants' descriptions and meanings throughout data collection and analysis, rather than rely on questionable pre-existing variables. Finally, the design must be organized in a way that allows interested parties to trace analysis and evaluate the trustworthiness of the study.

Given these requirements, a qualitative research approach is apt. Qualitative approaches are appropriate for exploratory studies into understudied topics (Creswell 2012). They give voice to experiencing individuals and are designed to help the

researcher maintain openness to participants' descriptions and communicate complexity to interested readers.

Crotty (1998) breaks down the design of social research into four distinct and logically connected elements: Epistemology, theoretical perspective, methodology, and methods. These elements are inherent in any scientific research, but unlike quantitative researchers, qualitative researchers typically make their epistemological and theoretical perspectives explicit prior to describing their methodologies and methods. This is partly to ground their methodologies so that the trustworthiness of their studies can be evaluated, and partly because there is so much diversity in epistemological and theoretical perspectives in social research (Punch 1998). I have structured this section on research design according to Crotty's (1998) elements, and I have added sections on ethics and trustworthiness.

a. Epistemological stance: Personal constructivism

"Most contemporary qualitative researchers nourish the belief that knowledge is constructed rather than discovered" (Stake 1995, p. 99).

The Encyclopedia Britannica defines "epistemology" as the study of the origin, nature, and limits of knowledge. More straightforwardly, epistemology tells us "how we know what we know" (Crotty 1998, p. 8). Science "is a knowledge-producing enterprise" (Giorgi 2009, p. 1), and scientists seek stable knowledge through attention to evidence and adherence to logic. Consequently, a scientist's epistemological stance provides logic for their research designs and gives shape to their findings by informing how they search for and establish knowledge.

Epistemologies can be visualized as lying along a spectrum, with objectivism and subjectivism inhabiting the ends. Objectivism originated in ancient Greek philosophy, peaked in the Age of Enlightenment, and has been the dominant paradigm in Western science since the 17th century (Crotty 1998; Giorgi 2009). According to objectivism, meaning resides in worldly objects. Conscious subjects build knowledge about the objective world by discovering these intrinsic meanings, and knowledge is limited by scientists' methods of choice (e.g., observation for empiricists, reason for rationalists, etc.). On the other end of the spectrum, according to subjectivism, meaning resides in the minds of conscious subjects (Crotty 1998). Conscious subjects impose meaning on objects, and the bounds of their cognitions limit knowledge.

Constructivism stretches across the middle of the epistemological spectrum. According to constructivism, conscious subjects construct meaning as they interact with objects (Crotty 1998). Unlike objectivism, constructivism does not take the view that objective reality comes equipped with its own meaning; and unlike subjectivism, it do not consider meaning to be created solely in the mind and imposed wholesale on objects. Instead, constructivism argues that subjects systematically generate knowledge in partnership with the objects they encounter, based on both of their characteristics. Knowledge is "at once objective and subjective" (Crotty 1998, p. 48) and cannot come into being apart from interactions between subjects and objects. As Crotty (1998) summarizes, "[N]o object can be adequately described in isolation from the conscious being experiencing it, nor can any experience be adequately described in isolation from its object" (p. 45). This viewpoint draws heavily upon philosopher Franz Brentano's (1838–1917) concept of intentionality. Crotty (1998) explains that "intention" is derived

from the Latin word *tendere*, which means "moving towards" or "directing oneself to." According to Brentano (1973), consciousness is always directed toward, or intends toward, an object. Thus, according to constructivism:

> [W]e do not create meaning. We construct meaning. We have something to work with. What we have to work with is the world and objects in the world. (Crotty 1998, p. 43-44)

It follows that knowledge is limited by objects' properties, subjects' cognitive capabilities, and the nature of their interactions, and although subjects build knowledge in relation to the properties of the objects they interact with, their knowledge reflects but does not reveal objective reality.

The current study is guided by constructivism in general. Constructivism encompasses two further categorizations: Personal constructivism and social constructionism. Many authors have expounded on the similarities and differences between personal constructivism and social constructionism (see Crotty 1998 and Young and Collin 2004 for reviews). In brief, personal constructivism focuses on knowledge generation through individual cognitions, while social constructionism focuses on knowledge generation through social processes. Personal constructivism is the stance that knowledge is constructed through cognitive processes that take place in a systematic relationship with external reality, while social constructionism is the stance that knowledge originates from, and is constructed through, social processes.

Personal constructivism in particular guides the current study. Philosopher Immanuel Kant (1724–1804), a progenitor of contemporary personal constructivism (Mahoney 2003; Mahoney and Granvold 2005), argued that conscious humans generate meaningful knowledge of the external world through organization via mental

categories; organization through cognition remains a central theme of personal constructivism. But, although personal constructivists focus on individual knowledge generation and organization through cognitive processes, most acknowledge that individual cognitions and constructions systematically relate to, and are even derived from, the social world (Young and Collin 2004). Mahoney (2003) and Mahoney and Granvold (2005) summarize five key characteristics of personal constructivism, which I have paraphrased here. The first two points focus on individual agency in knowledge creation through organization, while the next two points connect individuals to their social worlds. The final point emphasizes that humans have the capacity for change throughout their entire lives.

- Active agency: Humans are active agents in their own experiences.
- Order: Humans strive for stability by organizing their experiences through patterning, typifying, and categorizing. Organization is based on contrasts and is largely unconscious and habitual, and emotions are powerful biological forces of self-organization. It is through this organization that humans construct meaning.
- Self: Humans are bound by their bodies, and organization therefore is self-referential. However, the self is not static; it changes in a systematic way primarily in relationship to others, and in an effort to find balance.
- Social-symbolic relatedness: Humans are fundamentally social, and they use language, symbols, and social systems to organize themselves and their worlds.
- Lifespan development: The development of the self is never done, and humans have the capacity for change throughout their lifetimes. Changes to the self can be small, but in some cases, change is rapid and large.

Although objectivism has dominated Western science since the 17th century, the tenets of constructivism are consistent with the creative, tentative, social, and multi-faceted nature of science (Lederman et al. 2002). References to constructivism in scientific research are growing, most visibly in the social sciences (Crotty 1998), and constructivist stances have been trending in career research since the 1980s (Brown 2002; Young and Collin 2004; Patton and McMahon 2014; McMahon 2014). Given this background, and that the current study depends upon understanding how individuals experienced and made sense of voluntarily exiting the atmospheric science occupation, personal constructivism is a solid foundation in which to ground this study.

b. Theoretical perspective: Husserl's transcendental phenomenology

> Research in the constructivist vein […] requires that we not remain straitjacketed by the conventional meanings we have been taught to associate with the object. Instead, such research invites us to approach the object in a radical spirit of openness to its potential for new and richer meaning. (Crotty 1998, p. 51)

The epistemology of personal constructivism establishes that individuals mentally construct knowledge as they interact with other subjects and objects in the world, and that knowledge is limited by the nature of those interactions. A theoretical perspective, as "a way of looking at the world and making sense of it" (Crotty 1998, p. 8), fills in the details of how individuals articulate knowledge as they interact with the world and communicate knowledge thereafter. Certain theoretical perspectives flow logically from certain epistemologies: Positivism follows from objectivism; postmodernism follows from subjectivism; and phenomenology follows from personal constructivism (Crotty 1998). The current study is grounded in the theoretical perspective of phenomenology, which Crotty (1998) says is so intertwined with

constructivism that "one could hardly be phenomenological while espousing either an objectivist or a subjectivist epistemology" (p. 12).

German mathematician and philosopher Edmund Husserl (1859–1938) is regarded as the founder of contemporary phenomenology. Husserl began his academic career as a mathematician, studying under Leopold Kronecker and Karl Weierstrass at the University of Berlin. While studying mathematics, he developed an interest in philosophy and attended philosopher and psychologist Wilhelm Wundt's lectures. After obtaining his doctorate in mathematics from the University of Vienna in for his dissertation on the calculus of variations, Husserl studied there for two years under Franz Brentano. He then pursued his habilitation in philosophy under Brentano's student, Carl Stumpf, at the University of Halle and submitted his dissertation, *On the Concept of Number*, in 1887.

The empirical methods of natural science dominated Western scientific norms by Husserl's time, and European philosophers were attempting to model those methods. Although Husserl (1983) described himself as an admirer of the natural sciences, he saw the conversion of philosophy into natural science as misguided, and he called the philosophers who pursued it "blinded by naturalism" (Husserl 1965, p. 154). Drawing on his background in the theoretical science of logic, he sought to securely ground philosophy in particular, and science in general, in a theoretical "universal and pure science of the spirit" (Husserl 1965, p. 155) rather than a normative science like natural science, which prescribes what is "good" or what "should be" done or is otherwise value-laden (Smith 2013). To do this required returning to the source of knowledge: consciousness.

In his quest to establish a foundational theoretical science that could support both philosophy and natural science, Husserl founded contemporary phenomenology. He laid the foundations of his philosophy in his reflections on the independence of mathematical logic from consciousness in *Logical Investigations* (Husserl 1970) and refined and expanded those ideas into a transcendental phenomenological philosophy and accompanying method in *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy* (*Ideas I*; Husserl 1983). During retirement, he reiterated his philosophy in four lectures given at the Sorbonne in 1929 and compiled and expanded upon the lecture content in the *Cartesian Meditations* (Husserl 1977a). Besides these and several other seminal works, Husserl also left behind 40,000 pages of unpublished work upon his death that is still being evaluated by philosophers (Giorgi 2009; Smith 2013; van Manen 2014). Because Husserl's writings are so dense, this discussion summarizes the major and salient parts of his transcendental phenomenology as articulated by Husserl himself; his student Eugen Fink; Canadian educator and pedagogical researcher Max van Manen; the Standard Encyclopedia of Philosophy and contributing scholar David Smith; educational psychologist John Osborne; and American psychologist Amedeo Giorgi. Giorgi is a leading practitioner of Husserl-inspired psychological phenomenology and he developed the phenomenological psychological methodology (Giorgi 2009) used to guide the current study, which will be discussed in detail in the next sub-section.

Understanding phenomenology hinges upon its particular use of the word "phenomenon." The meaning of "phenomenon" is derived from the Greek *phainomenon,* which means "appearance" (Smith 2016). Drawing upon Brentano's

intentionality as the defining structure of consciousness, Husserl (1983) defined phenomena as objects-as-they-appear-to-consciousness, as opposed to objects as they exist apart from conscious experience (Giorgi 2009; Smith 2013, 2016; van Manen 2014). In simpler terms, a phenomenon is "something that is present to consciousness" (Giorgi 2009, p. 10), where that "something" can be real or irreal.[7] Humans perceive and build knowledge from phenomena, not from objects themselves, because "consciousness is basically a medium between a person and the world" (Giorgi 2012, p. 9). Accordingly, knowledge of objects is uncertain because humans must rely only on what is given to consciousness, whereas knowledge of phenomena is certain for this same reason. Thus, phenomenology is not objectivist, because it "does not study the 'what' of our experience but the 'experience' of the what" (van Manen 2014, p. 91). Put another way, phenomenology is not interested in "an analysis that would exclude the experiencer, but rather in a precise analysis of how the 'given is experienced by the experiencer" (Giorgi 2009, p. 4). Even with this experiential focus, phenomenology is not subjectivist, because knowledge is constructed from meaningful relationships between subjects and phenomena and not created from consciousness alone. Furthermore, phenomenology is broader them empiricism, since phenomena are intuited rather than sensed.

Husserl provided logic to explain how individuals construct and communicate knowledge as they experience the world. The basic assumption of phenomenology is

[7] Husserl (1983) explains that real objects are bounded by space, time, and causality; irreal objects lack at least one of these characteristics. Giorgi (2009), van Manen (2014), and Smith (2016) add that real objects have material existence apart from consciousness, whereas irreal objects do not.

that any lived experience has a distinct, invariant "essence" (Husserl 1983). An essence is an experience's unique structure that enables individuals to recognize any given experience as a certain type, and without which an experience would not be recognizable as a certain type. A given type of experience may be imbued with different concrete details in different instances, but its essence is "an identical sense that covers multiple factual variations" (Giorgi 2009, p. 84). In other words, an essence includes the necessary elements that give definite structure to all instances of that type of experience. It follows that essences transcend individual psychology and therefore are invariant, or "universal." This leads to the second major assumption of phenomenology: Essences are given directly to consciousness, and individuals can comprehend them without interpreting them using pre-knowledge, hypotheses, or theories.

Humans are not used to operating in an attitude of openness to direct conscious experience. Instead, typically operate in the "natural attitude" of everyday life (Husserl 1983; Giorgi 2009). In the natural attitude, humans take for granted that objects exist exactly in the ways that their corresponding phenomena are experienced, and they make sense of their experiences by interpreting phenomena by bringing in non-given factors such as hypotheses, theories, and assumptions. Despite this difficulty, Husserl (1983) maintained that it was possible for individuals to set aside the taken-for-granted personal and socio-cultural meanings they automatically assign to experiences in everyday life and attend to phenomena as they present themselves directly to consciousness. This would require deliberate attentiveness to the action of imposing pre-givens on experience, so that the everyday way of understanding could be set aside. Then, in a new attitude that transcends the natural attitude, an individual would be able

to mentally interrogate phenomena, intuit their essences, and describe those essences precisely.

Since the normal human attitude is one of interpretation rather than transcendence, Husserl (1983) provided a method to achieve the transcendental attitude: the transcendental phenomenological reduction. The word "reduction" is derived from the Latin *reducere*, which means "to lead back" (van Manen 2014). The transcendental phenomenological reduction leads one back to the perspective of pure consciousness by enabling a break from the natural attitude. This is accomplished through the performance of two mutually conditioned, self-meditative "moments" (Fink 1995; Smith 2016). The first moment is the *epochè*, which is Greek for "suspension" or "abstention" (van Manen 2014). In the *epochè*, the phenomenologist suspends considerations about whether or not an object actually exists in the way it is given to their consciousness as a phenomenon. The phenomenologist also abstains from imposing pre-suppositions on the phenomenon, even if something about it seems confusing, unclear, or incomplete, as this would "diminish the present experience" (Giorgi 2009, p. 91). Drawing on the use of parentheses to separate mathematical operations, Husserl (1983) referred to these acts of suspension as "bracketing." Bracketing creates a state in which one is fully present to direct and immediate conscious experience, rather than focus on the underlying objects. One does not forget their past knowledge when they bracket it out, but they keep "a tension between the past and the present in order to discern their respective roles" (Giorgi 2009, p. 93). To enter the *epochè* is to be "fully attentively present to an ongoing experience rather than habitually present to it—or, perhaps better—be present to it as we are in the natural

attitude" (Giorgi 2009, p. 92–93). The second moment of the transcendental reduction is the "reduction proper" (Fink 1965; Smith and McIntyre 1982; Smith 2016), in which one recognizes that everyday knowledge is accepted but not an absolute, including knowledge about consciousness itself. Since one entering the *epochè* would already recognize that there is a benefit to moving toward the realization of the reduction proper, and entrance into the *epochè* enables attainment of the reduction proper, it is clear that the *epochè* and the reduction proper are mutually conditioned moments and not steps in a process.

Once the phenomenologist has taken on the transcendental attitude, they are able to regard a phenomenon of interest as it is given to their consciousness directly and search for its essences. This is accomplished through the eidetic reduction. In the eidetic reduction, the phenomenologist compares different instances of a phenomenon to determine what is essential to it. The phenomenologist also uses free imaginative variation, in which he or she mentally inspects the phenomenon as it appears to their consciousness and intuits "what it could be and could not be" (Osborne 1994, p. 171). To accomplish this, the phenomenologist mentally and systematically removes or changes aspects of a phenomenon. If the removal or change of some aspect transforms the phenomenon into a new type of phenomenon, that aspect is essential to the phenomenon. However, if the phenomenon is still recognizable as itself after removal or change, that aspect is nonessential. This is another major assumption of transcendental phenomenology: In the appropriate attitude, one can uncover the essences of a phenomenon through the eidetic reduction. In uncovering essences, the

phenomenologist answers the questions: What is it like to experience this phenomenon? How does one experience the phenomenon (Giorgi 2009; van Manen 2014)?

Finally, the phenomenologist uses language to describe the essences of a phenomenon. Connecting back to those phenomenological questions, the phenomenologist "seeks to describe what shows itself in experience or consciousness and how something shows itself" (van Manen 2014, p. 229). This description of essences is ultimate product of the phenomenological method.

In summary, phenomenology is the study the structures of conscious experience from the first-person point of view (Smith 2016). The basic assumption of phenomenology is that phenomena are structured by definite universal essences that present themselves directly to consciousness through experience. Further assumptions are that individuals can enter a transcendental attitude to intuit essences; explicate them using comparison and free imaginative variation; and describe them with language. The methods to access and explicate essences are the transcendental phenomenological reduction (made up of the *epochè* and the reduction proper) and the eidetic reduction. Fink (1970) referred to the transcendental reduction as "the basic method of Husserl's phenomenological philosophy" (p. 72), and Giorgi (1997, 2009) specified the *epochè* as the minimum condition necessary to practice phenomenology. Together, the transcendental and eidetic reductions form the transcendental phenomenological method, which "investigates the way that knowledge comes into being and confronts us with the assumptions upon which all human understandings are grounded" (van Manen 2014, p. 91) and provides stable knowledge through the determination of essences. Finally, essences are eidetic rather than factual, based on cognitions and not just

observations. Although the eidetic reduction can be assisted by reference to empirical examples of the phenomenon (van Manen 2014), the work of finding essences is purely mental. Therefore, phenomenology is broader than empiricism: It is a theoretical, eidetic science, "the science of the essence of consciousness" (Husserl 1983, p. 33ff) rather than a "science of facts" (Husserl 1983, p. 5).

A theoretical perspective's assumptions provide scientific research projects with logic that shapes how data is collected and analyzed (Ezzy 2002). Because phenomenology requires bracketing the natural attitude and taking a critical look at phenomena without resorting to habitual interpretations, phenomenology "is first critique, most basic critique, a radical and necessary element in all human inquiry […] and phenomenology may be viewed as essentially a starting point" (Crotty 1998, p. 85) in social inquiry. Additionally, phenomenology is suited to the study of experiences of mental phenomena like perceptions, emotions, moods, ideas, dreams, and desires. I have chosen phenomenology as the theoretical starting point for an investigation of exits from the atmospheric science occupation, because it allows for the uncovering of new facets and nuances, because it attends respectfully to the experiences of participants, and because it facilities study of mental phenomena. The details of translating philosophical phenomenology into a scientific methodology are described next.

c. Methodology: The Descriptive Psychological Phenomenological Method

Social scientists have drawn from the theoretical perspective of phenomenology and constructed phenomenological research methodologies in order to access and understand human experience (Creswell 2012). Phenomenology's requirement for

openness to experiences as they are lived enables researchers to uncover the general structures of experiences, and thus phenomenological methodologies are appropriate for exploratory study of phenomena that either have not been previously investigated or are not well understood (Crotty 1998; Giorgi 2009). The phenomenon of voluntarily exiting the atmospheric science occupation has not been studied at all, and it is not clear what findings from existing general voluntary turnover literature would relate to it. Any choice of variables would come from tradition and surmise, and this would threaten the fidelity of the findings to the actual experience. To avoid imposing possibly irrelevant hypotheses, assumptions, or variables from existing voluntary turnover studies, I chose instead to be open to experiencing individuals' descriptions of voluntarily exiting the atmospheric science occupation. I modeled my study on Giorgi's (2009) descriptive phenomenological methodology for psychology (DPPM; also called the scientific phenomenological method to emphasize its applicability to other disciplines) to accomplish this.

Giorgi is an American psychologist. He is perhaps best known as one of the founders of the phenomenology doctoral program in the Duquesne University Department of Psychology, whose scholars began forwarding phenomenological psychological research in the early 1960s, and as the founder of the *Journal of Phenomenological Psychology*, which was established in 1970. Although Giorgi began his academic career as an experimental psychologist, he was interested in understanding "the whole human person" (Giorgi 2012, p. 3) and he transformed himself into a humanistic psychologist. As Husserl disparaged modeling philosophy on the natural sciences, so Giorgi argued that movement to model psychology on the natural sciences

by adopting empiricism as its central theoretical perspective "restrained the development of psychology" (Giorgi 2009, p. 14). This was because, while observation and experimentation are useful for studying the body and overt behavior, they limit the study of irreal cognitive phenomena like consciousness, ideas, meanings, memories, images, dreams, and hallucinations. Such irreal phenomena are "essential characteristics of humanness" (Giorgi 2009, p. 70), and they require rigorous scientific study that attends to their qualities. Observation and experiments are not able to illuminate invisible cognitive processes, and a research strategy was needed to attend to them effectively. Therefore, Giorgi's (2009) goal was to answer the question: "How does one analyze a description of a concrete experience in a psychologically meaningful way and achieve at least the same degree of objectivity that quantitative analyses reach?" (p. 121).

To answer this question, Giorgi (2009), like Husserl, revisited the "medium of access for any knowledge whatsoever" (p. 68): consciousness. To keep scientific knowledge and consciousness bound together while allowing for study of both real and irreal psychological phenomena, he forwarded Husserl's transcendental phenomenology as a better theoretical foundation for psychology than empiricism. Over several decades, he used human science and psychology perspectives to adapt Husserl's phenomenology for scientific study of psychological phenomena, and his efforts culminated in the DPPM.

There are a couple of leaps from transcendental phenomenology to a phenomenological research methodology like the DPPM. First, phenomenological philosophers seek to understand experience from a transcendent mode of consciousness,

whereas social scientists seek to understand everyday experience (Giorgi 2006, 2009; Englander 2012). Fortunately, Husserl (1977b, 1983) defined the psychological reduction in addition to the transcendental reduction. In the psychological reduction, the researcher still performs the *epochè*, but the phenomenon of interest is presented in the natural attitude. Thus, the psychological phenomenological reduction extends the base of experiences available for phenomenological analysis by allowing for study of everyday experiences as well as transcendental experiences (Giorgi 2009, 2012), and it is the starting point for the DPPM.

The psychological phenomenological reduction enables the second leap from transcendental phenomenology to research methodology: A phenomenological methodology must allow scientists to study others' experiences instead of their own experiences. Husserl (1983) maintained that, since humans are empathic, descriptions of experiences are shareable through language; this assumption is implicit in the ultimate phenomenological goal of producing a precise description of an experience. Giorgi (2009) further argued that the psychological phenomenological reduction opens up participants' descriptions as objects for scientific study, since they will provide descriptions in the natural attitude.

The *epochè* is the linchpin of Husserl's phenomenological method and "the minimum condition necessary to claim phenomenological status for one's research" (Giorgi 1997, p. 241). As such, the researcher begins the DPPM by performing the *epochè*. They bracket their pre-knowledge and commit to abstaining from evaluating participants' descriptions with non-given factors like hypotheses, assumptions, or other interpretations. The DPPM does not, however, require that the participants who have

experienced the phenomenon of interest perform the *epochè*. It is better that they remain "phenomenologically naïve" (Giorgi 2009, p. 99) so that their descriptions, as the empirical contents of study, can be given in the everyday attitude.

After performing the *epochè*, the researcher elicits rich descriptions from one participant at a time, usually via semi-structured interviews, about their lived experience of the phenomenon of interest. Since the participants do not bracket, their descriptions are layered with their personal, social, cultural, and historical meanings. Consistent with the tenets of constructivism, the concrete details of recounted instances of the experience of interest from multiple participants will be different, as each participant draws upon their own backgrounds to organize, construct, and communicate meanings differently (Crotty 1998; Giorgi 2009). The eidetic reduction, as the other calling card of Husserl's phenomenological method that is retained in the DPPM, is well suited to accommodate this intrastructural variability in participants' descriptions while going beyond them to find a phenomenon's underlying structure (Giorgi 2009). After collecting and transcribing interview data, the researcher interrogates the data for eidetic insights into the phenomenon of interest. The interview data serve as an important empirical basis for the eidetic reduction to alleviate some of researcher's mental labor, as the researcher can compare multiple empirical instances of the phenomenon and use them to facilitate free imaginative variation. Since the researcher is still in the *epochè*, they consider the descriptive data as it was given by participants. This type of descriptive analysis "attempts to understand the meaning of the description based solely upon what is presented in the data" (Giorgi 2009, p. 127), without employing interpretive strategies to clarify ambiguities or make the data fit existing theory. The

researcher may go back to the participants for additional data to clarify confusing points, but they may not use their own interpretations to make clarifications.

Finally, based on the efforts from the previous lengthy step, the researcher composes the general structure of the experience of interest. The general structure expresses what it is like for an individual to live through the experience of interest and how that type of experience comes about. Although the general structure should accommodate all empirical results obtained through interviews, the general structure is not a summary of the empirical results. Rather, the general structure communicates the key meanings without which the experience would not be itself, and it reports relationships among those key meanings. In this way, the general structure clarifies and deepens understanding of an experience (Giorgi 2009). In keeping with phenomenology's commitment to description, the general structure is descriptive rather than interpretive because such results "are more secure" (Giorgi 2009, p. 128), both theoretically and in that they can be directly checked against an interview transcript without referring to the researcher's invisible mental application of a disciplinary perspective. Giorgi (2009) warns the researcher to keep in mind that the structures that come out of the DPPM are psychological, not transcendental, due to the performance of the psychological rather than transcendental reduction: "One has to remember here that the structure is meant to be a psychological one that reveals the psychological aspects of the experience in a heightened way" (p. 103). He avoids calling the general structure an essence to make this distinction between psychological and transcendental clear, which is a practice that other phenomenological researchers also recommend (Osborne 1994).

In summary, the DPPM maintains the central tenets of Husserl's philosophy while fulfilling the requirements of science in general and psychology in particular. Attendance to the psychological reduction, in which the researcher performs the *epochè* but the participants providing descriptions of the experience of interest do not, enables social scientists to study of what it is like to experience phenomena and how those experiences come about by giving voice to experiencing individuals. The psychologically sensitive attitude that results from the psychological reduction is not as extreme as the transcendental attitude of phenomenological philosophy, but it is appropriate and helpful for understanding how experiences are lived in everyday life. The researcher remains fully attentive to participants' accounts throughout data collection and analysis. He or she compares and varies the participants' multiple empirical instances as part of the eidetic reduction to search for the general structure of the experience. This general structure of the experience that results from this work is the final product of the DPPM. This type of description is of interest to social scientists, especially psychologists, because it "tries to understand the natural attitude better than the natural attitude can understand itself" (Merleau-Ponty 1962, p. 26). Further practical guidelines for the DPPM's steps as they were applied to the current study are described in the next section.

As implied above, the DPPM lends itself well to qualitative methods like interviewing. One might ask, what, then, makes the DPPM different from other qualitative research approaches? Bracketing out researcher bias, after all, is a staple of research in general and qualitative research in particular in order for the researcher to remain neutral, to give participants voice, and to listen closely to their descriptions

(Ezzy 2002). Beyond this, the *epochè* brackets out assumptions about the existence of phenomena as described, which makes them even more present to the participants' accounts. Additionally, phenomenological bracketing is an ongoing effort that aims to prevent the researcher's interpretations from entering at any point during data collection and analysis. This commitment to avoiding the researcher's disciplinary interpretations is especially unique, as other qualitative methodologies utilize researchers' interpretations in analysis (Morse 1994; Merriam 1998; Crotty 1998; Shank 2002; Saldana 2009; van Manen 2014). Second, the research questions that guide a phenomenological study are very broad in order to be as open as possible to the experiences of interest as it was lived, rather than focusing on particular aspects that the researcher assumes are important. Third, the use of free imaginative variation to determine the general structure of an experience differentiates phenomenological research from empirical, inductive qualitative research. Culminating a study with interpretations based on disciplinary studies and theories would not satisfy phenomenology's requirement for description of invariant knowledge: Findings must be eidetic and deepen the understanding of an experience beyond the collected empirical instances of it. Fourth, phenomenological research designs such as the DPPM are restricted to study of lived experiences, not hypotheses, opinions, or other non-direct experiences.

d. Methods

"[A]cknowledgement of the consciousness of the participant and his or her humanness should be the point of departure for rethinking the research situation for the human science" (Giorgi 2009, p. 85).

A phenomenological research approach lends itself especially well to qualitative methods, since the goal of phenomenological research is to describe the structures of experience as completely and richly as possible (Giorgi 2009). My overview of the DPPM hinted at several typical qualitative methods. In this section, I describe my methods explicitly, and supplement them with several of Hycner's (1985) DPPM-inspired recommendations.

1) BRACKETING

The self-meditative *epochè* must be begun prior to data collection and analysis. Hycner (1985) recommended that, as part of bracketing, researchers outline their pre-suppositions to the best of their abilities. Giorgi (2006) cautioned that simply listing pre-suppositions might inspire exaggerated confidence in this method of bracketing, and he further recommended that researchers detail the roles their pre-suppositions could play in analysis so that both the researcher and readers could better detect bias. Following both of their recommendations, as well as the recommendations of general qualitative research overviews, I have included a subjectivity statement (Appendix A) that positions my experiences and interests in relation to the research purpose and addresses limitations that I as the research instrument could create. Hycner (1985) also recommended that researchers discuss their pre-suppositions with others to help them better understand their biases. To this end, I performed a pilot study in a qualitative research methods graduate class in an educational psychology department and discussed my relationship to the study with my professor and classmates.

The *epochè* must be maintained throughout data collection and analysis. To keep the *epochè* at the forefront of my mind during data collection, I referred to my interview

protocol (Appendix B) and repeatedly asked the participants if there was anything that was over- or under-emphasized or completely missed during their interviews. During data analysis, I continually compared my work against the participants' interview transcripts as the empirical basis of the study, to make sure that my pre-suppositions were not coloring the analysis. I also sent the participants narrative summaries for a further check.

2) SAMPLING

I used a purposive sampling strategy to recruit participants (Patton 1990; Ezzy 2002; Punch 2004). In purposively sampling, a researcher deliberately recruits and selects participants to best serve the research purpose and answer the research questions. While random sampling helps researchers generalize their results, purposive sampling helps researchers collect in-depth information and provide great detail on a topic of interest.

Part of my purposive sampling strategy drew from criterion sampling (Patton 1990). There are two necessary criteria for a phenomenological study: Participants (1) must have experienced the phenomenon of interest and (2) must be willing and able to convey their experiences in great detail (Giorgi 2009; Englander 2012). To ensure the first criterion, I required that participants held at least a bachelor's degree in atmospheric science or meteorology and had worked in the atmospheric science occupation for at least six months before voluntarily leaving it. I communicated with each participant about the study purpose and their educational and work histories via email or phone call after they contacted me about participating. Additionally, I required that participants self-identified as having voluntarily left the atmospheric science

occupation, rather than rely on my own determination, to ensure that they personally felt that they had lived the experience of interest and could describe it richly. Higgins (2001) also recommended this practice to properly highlight the subjective side of voluntary turnover and to guard against misinterpretation by the researcher. In order to focus on their exit experiences, I did not impose criteria on what the participants did after exiting the atmospheric science occupation; for example, they may have pursued work or education in another occupation, or they may have exited the workforce altogether. To ensure the second of the above criteria, I briefed participants on informed consent and sent them a consent form to read before we scheduled our interviews (Appendix C). I also emphasized that interviews would be open so that they could provide as much detail as they liked.

Phenomenological research approaches deliberately incorporate variation into samples. It is "vital for the determination of meanings" (Giorgi 2009, p. 68) that different instances of the experience of interest are collected for comparison; otherwise, the eidetic reduction is hindered because "a tremendous burden is placed on the imagination when it tries to distinguish the single individual's particular way of living the phenomenon from a more general way that belongs to a type rather than to an individual" (Giorgi 2008, p. 36). The two broad criteria described in the previous paragraph allowed for variations in participants' ages, genders, and educational and work histories.

Voluntary atmospheric science leavers are a hidden population. Occupational leavers may not feel the need to maintain membership with professional organizations, and their former educational departments or employers may not record their exits, or

they may not be willing to reveal contact information if they do record it. Thus, voluntary atmospheric science leavers are best accessed through the people they know. To this end, I also drew upon snowball sampling for my purposive sampling strategy (Patton 1990). I designed and published a brief survey through the University of Oklahoma (OU) Qualtrics program. Through this survey, I asked if survey participants held at least a bachelor's degree in atmospheric science or a related a field; if they had worked in the atmospheric science occupation for at least six months; and if they identified as having voluntarily left the occupation. These initial questions did not require responders to provide identifying information. After these questions, I provided an optional comment box for responders to provide identifying information if they wished to be contacted for interviews. I distributed the survey link to several of my professional contacts (informants; Patton 1990), along with a script giving them information about my study and inviting them to help me pass along my student information. Informants sent the survey link and another script describing the study directly to individuals they knew who might be interested in either participating themselves or sending the survey link and script to others. Informants also posted the survey link and script to departmental websites and social media pages, and they emailed the survey link and script to networks of co-workers and alumni from atmospheric science departments and scholarship programs. I also distributed the survey link and script to a few of my own acquaintances that I thought might have interest in participating in the study.

While there is no fixed minimum number of participants needed to conduct phenomenological research, there must be enough to provide sufficient variation to

assist determining the general structure of a phenomenon. Morse (1994) recommended at least six participants, Giorgi (2008, 2009) recommended at least three participants, and Creswell (2012) recommended at least five participants. Additionally, Giorgi (2008, 2009) and Creswell (2012) recommended a maximum of 25 to 30 participants. These upper bounds are consistent with general sampling guidelines outside of grounded theory (Patton 1990), as qualitative analysis is a time- and energy-consuming process, and the resources available restrict the number of accounts that can be reasonably analyzed. Giorgi (2009) also cautioned against larger samples due to the practical and imaginative labor of phenomenological analysis. I continued to recruit and interview participants until I felt that no new information was emerging from interviews (redundancy; Lincoln and Guba 1985). I began to get a sense of redundancy around the tenth participant. Ultimately, I recruited and interviewed 17 participants. I removed two participants from analysis because their work experiences in the occupation were only in graduate school, and I wanted to be cautious and avoid the possibility of blending different experiences. I also removed one participant from analysis because the recording device failed. Thus, I analyzed interview data for 14 participants.

Information on the participants' demographic, educational, and work backgrounds are given in Appendix D to highlight sample variation. The sample was split fairly evenly by gender, with eight men and six women. Prior to exiting the atmospheric science occupation, four participants (two men and two men) worked strictly in the public sector of the atmospheric science occupation; six participants (four men and two women) worked strictly in the private sector; three participants (two men and one woman) worked in both the public and private sectors; and one participant

worked in the academic sector. The majority of participants worked as weather forecasters, researchers, and trainers, and several worked with using media to disseminate forecasts. The men were on average 27 years old (with a range of 22 to 31 years) at the time of their exits, and the women were on average 30 years old (with a range of 26 to 32 years old) at the time of their exits. The men were on average employed in the atmospheric science occupation for five years (with a range of two to nine years) before exiting, and the women were on average employed in the occupation for 6 years (with a range of two to nine years) before exiting. On average, about 3 years (with a range of 0.5 to 4 years) had passed for the men since their exits, and about 2 years (with a range of 0 to 4 years) had passed for the women since their exits. Although it was not a criterion of the study, all of the participants took work in other occupations after their exits, as detailed in Appendix D using classifications consistent with the BLS.

Although my small sample size inhibits statistical generalization to the general population of voluntary atmospheric science leavers, theoretical generalization is possible due to the eidetic reduction and the search for the general structure of experience (Creswell 2012, Giorgi 2009). Giorgi (2009) described the general structure as a measure of central tendency like the mean, median, and mode, in that it must allow for most or all of the variations in the raw data and thereby transcend the individual interviews.

3) INTERVIEWING

"The aim of qualitative research is to allow the voice of the 'other', of the people being researched, to inform the researcher" (Ezzy 2002, p. 64).

Like many qualitative researchers (Patton 1990; Fontana and Frey 1994; Ezzy 2002; Punch 2004; Kvale and Brinkman 2009), Crotty (1998), Giorgi (2009) and Englander (2012) recommend that phenomenological researchers elicit descriptions from participants using semi-structured interviews. Semi-structured interviews are guided by pre-determined but open questions to keep participants on topic while empowering them to provide as much detail as they would like and without directing them to respond in certain ways. A protocol for a semi-structured interview provides suggestions for possible questions, but the researcher will compose many specific questions as the interview goes along. Semi-structured interviews are preferable to written descriptions for phenomenological research because participants generally convey more detail verbally than they do via the more exhausting work of writing (Giorgi 2009). This type of interviewing enables the researcher as interviewer to insert relevant probing questions to elicit greater detail or clarify unclear points, and the researcher can quickly address discomfort that arises from discussion of emotional experiences. It also creates a more spontaneous atmosphere, whereas the time needed to compose a written description may break participants from the everyday attitude and decrease the freshness of their descriptions.

Specific to phenomenological approaches, interview questions should be broad in order to facilitate the *epochè* throughout data collection. Giorgi (2009) counts descriptions given by participants as "adequate" if they contain "sufficient depth and detail so that some new psychological knowledge about the phenomenon can be obtained" (p. 125), and he encourages researchers that this type of description is attainable if interview questions are sufficiently broad. To avoid gathering data on

opinions, hypotheses, or indirect experience, basic phenomenological interview question should take the form: Please describe for me a situation in which you experienced the phenomenon of interest. Using these guidelines, I designed an interview protocol (Appendix B) to guide my interviews with each participant. I composed broad interview questions to give the participants the space to speak fully about their experiences, and I included possible probing questions to encourage them to provide great detail.

I conducted interviews from January to April 2016. I conferred with each participant via email prior to meeting to determine a mutually agreed upon date, time, and location; to send them a consent form (Appendix C); and to gather details about their educational and work backgrounds. I made myself available to the participants via email or phone prior to meeting to answer any questions or concerns they might have about informed consent or some other aspect of the study. The participants returned their signed consent forms prior to being interviewed, and I provided them with a copy to keep for their records.

I interviewed one participant in person at a public café, and I interviewed the rest of the participants by Skype video or voice call or regular phone call. I began each interview by going over the consent form one more time in order to restate the points and answer any remaining questions the participant had. After discussing the consent form, I gave the participant space to ask any questions or voice any concerns before beginning the interview. I also emphasized that they were free to refuse to answer any question I asked, stop the interview at any time, and remove their data from the study at any time. After they assented to the interview, I started the Voice Record Pro

application on both my smartphone and tablet to record audio. I also jotted notes throughout the interview.

Interviews lasted one to two hours and were conducted approximately according to the interview protocol. I began by reviewing the purpose of the study and alerting the participant to the broadness of the upcoming interview questions. To establish rapport—which Giorgi (2009) cautions is a critical aspect of interviewing that is lost in over-concern about the interviewer appearing as neutral and inert as possible—I began by asking the participants about when they became interested in the weather. This question almost always seemed to "loosen up" the participants, and several expressed surprise that they were able to direct the interview from the outset. I followed up with questions about their education and work backgrounds in the atmospheric science occupation. After establishing the participant's background, I asked: Can you describe, in as much detail as possible, your experience of exiting the atmospheric science occupation? In many cases, this question did not have to be asked explicitly, because the participants' descriptions of their exits followed naturally from their accounts of their work histories. Because of this, no interview followed the protocol exactly, as participants answered this and other pre-planned questions without being prompted. I also injected various probing questions to help bring out details of their exit experiences as necessary and in response to their descriptions. After the participant appeared to have exhausted their description of their exit, I asked if there was anything that could have motivated them to stay in the occupation at that time, if there was anything that would motivate them to return, and if they still considered themselves to be atmospheric

scientists. As part of my closing remarks, I asked if there was anything they would like to add or clarify, or if there was anything we did not discuss. Often, the participant used this prompt to spontaneously summarize their exit experience and emphasize the points they found to be most salient to their experiences. I finished by reiterating that they could contact me at any time. After the interview was complete, I asked the participant what $10 gift card they would like in return for completing the interview, and I sent it to them within 48 hours of our interview.

Besides drawing upon Giorgi's (2009) and Englander's (2012) guidelines, I also drew upon feminist perspectives on interviewing (Punch 2004). Oakley (1981) identified openness, emotional engagement, and the development of trust as characteristic of feminist interviewing, as opposed to the traditional detachment of interviewer from interviewee. Fontana and Frey (1994) added that detachment fosters a hierarchical relationship, with participant as subordinate, which reduces the quality of data collected, and Giorgi (2009) warned that preoccupation with interviewer neutrality could lead to insensitivity. As such, I attempted to create an encouraging atmosphere by laughing when the participants injected humor into their accounts, expressing surprise when the participants recounted unexpected or shocking events, and using other interjections to respond to the participants' emotional states—in other words, using the reactions I would use in everyday life when listening to someone recount a humorous, dramatic, or otherwise emotional or important episode from their lives. At the same time, I kept the psychological phenomenological attitude in mind. Giorgi (2009) warned that strong identification with participants hinders analyzing their descriptions, and the

phenomenological interviewer must remember that they are in a different attitude than the participants.

4) EXPLICATION

Giorgi (2009) laid out and demonstrated four general steps for phenomenological data explication after transcribing interviews: (1) Read the interview transcript for sense of the whole; (2) break the transcript into meaning units; (3) transform the participant's natural attitude expressions in the meaning units into expressions that are both phenomenologically and psychologically sensitive; and (4) write the general structure of the experience. Giorgi (2009) noted that these steps allow explication to be tracked, even more so than in other qualitative studies where researchers interpret data from disciplinary perspectives. He also notes that his third step is the most laborious.

I followed Giorgi's (2009) guidelines and supplemented them with several of Hycner's (1985) recommendations. In particular, I augmented Giorgi's (2009) second step with Hycner's (1985) recommendation to discard irrelevant and redundant meaning units, and I augmented his fourth step with Hycner's (1985) recommendation to identify general and unique themes across all of the participants before writing the general structure of the experience. Additionally, I followed Hycner's (1985) advice to write individual narrative summaries and send them to the participants for member checks. Writing narrative summaries gave me another opportunity to honor a participant's whole experience by comparing their transformed meaning units and themes to the entire transcript, and sending summaries to participants provided valuable checks to enhance the study's credibility (Lincoln and Guba 1985). In sending summaries,

however, I heeded Giorgi's (2006) warning against allowing the phenomenologically naïve participants to comment on the explication of the general structure of the experience.

Both Hycner (1985) and Giorgi (2009) prefer to refer to the purpose of the DPPM as "explication" rather than "analysis." This is because analysis implies the breaking down of a complex whole into smaller parts, which contrasts with the holistic nature of a phenomenological description. Instead, "explication" emphasizes that smaller parts are still considered within the meaningful whole of the experience. Explication proceeded as follows:

- I transcribed audio recordings of the interviews verbatim and anonymized the data by replacing participants' names with pseudonyms and generalizing or redacting identifying descriptions. I transcribed recorded interviews as I continued to interview other participants in order to note weaknesses in my interviewing and improve my skills. However, for the sake of bracketing, I did not engage in further explication until all interviews were complete.
- One at a time, I analyzed each participant's interview transcript on its own.
    - I read the individual's transcript in full to reorient myself to their whole experience.
    - I separated the transcript text into general meaning units. This involved delineating sections of text where there appeared to be a shift in psychological meaning for the participant. Thus, the meaning units maintained the participants' words and broke the transcript into smaller parts to make explication manageable. Throughout this process, I was cognizant of erring on the side of

caution: If I was unsure whether or not a participant's meaning had shifted in the transcript, I broke that section into two meaning units to avoid mixing them. I recorded the meaning units in a Microsoft Excel spreadsheet.

- After delineating general meaning units throughout the entire transcript, I interrogated each unit for its relevance to the experience of voluntary exiting the atmospheric science occupation, and I also checked for redundancy. I discarded irrelevant or redundant meaning units; the meaning units that remained were relevant to the experience of voluntarily exiting the atmospheric science occupation and provided psychological depth. Again erring on the side of caution, if I was not sure if a meaning unit was redundant or irrelevant, I kept it rather than discarded it.
- I transformed each remaining meaning unit to reveal its relationship to the phenomenon of voluntary exiting the atmospheric science occupation. This involved re-phrasing for meaning unit while considering its psychological meaning and its relevance to the experience of interest. Similar to first cycle coding (Punch 2004; Saldana 2009), these phrases served both as labels to communicate the meaning of pieces of data and as indices to aid explication. In order to avoid interpreting the participants' descriptions, I used the participant's own words when they were especially revelatory (in vivo code), or I summarized the description contained in the meaning unit (descriptive code). I tagged some meaning units with two codes (simultaneous code), and I continuously referred back from meaning units to the interview to make sure that I was properly considering a meaning unit amid its context.

- I clustered relevant meaning units under general themes. General themes helped reveal the structure of the experience and assisted in integrating results across participants after all individual interviews were explicated. This process was similar to pattern coding (Punch 2004; Saldana 2009), in that descriptive codes were pulled together into higher-order categories. To move beyond inductive analysis, I additionally used comparison and free imaginative variation to look beyond the contingencies of the data to determine higher-level categories of meaning. Appendix E gives examples of relevant meaning units and their connections to higher-order general themes.
- I wrote a narrative summary of the participant's exit experience that incorporated their direct quotes, transformed meaning units, and themes. I continually cross-referenced themes, meaning units, and the whole interview while writing the narrative summary, and I compared the finished draft against the interview transcript before sending it to the participant for member check. All of the participants agreed to read their narrative summaries, and 11 responded via email or in person after reading their summaries. Each of the 11 responding participants confirmed the veracity of their narratives. Of those 11, seven required no changes; the remaining four participants requested small changes to fix details in their non-atmospheric science work histories, such as the length of time spent at a company, but they did not request changes to the bulk of the narratives.

- Once each participant's individual experience had been explicated, I brought all of the individuals' meaning units and themes together to identify general meanings and

themes across the participants. I also noted unique themes, as they add depth to understanding the variations in an experience. Giorgi (2009) noted that comparing and contrasting the most diverse individual meaning units and themes especially facilities the task of generalizing across participants.

- Based on the general and unique themes developed in the previous step, I composed the general structure of the experience of voluntarily exiting the atmospheric science occupation. To check the general structure, I compared it with the participants' transcripts, meaning units, and themes to make sure that it accommodated all of their experiences while deepening their psychological significance.

Although Hycner (1985) and Giorgi (2009) presented explication as occurring in sequential steps, and I have mirrored this in my report, it is important to keep in mind that the steps fed back on each other recursively. This somewhat disrupted the chronology of the steps but kept the focus on the whole experience and ultimately strengthened the resulting description.

A last note: Many stepwise phenomenology-inspired methodologies exist, such as Moustakas's (1994) heuristic phenomenological approach, Dahlberg et al.'s (2008) reflective lifeworld approach, and Smith et al.'s (2009) interpretive phenomenological analysis. Giorgi (2009) provided general steps for the DPPM, and even Husserl (1983) laid out general steps for the transcendental phenomenological method! However, Giorgi (2009) and van Manen (2014) advise against relying too heavily on phenomenological "cookbooks" that provide many pre-determined steps. The danger is that, when a phenomenological approach is "fitted to a rule book, an interpretive schema, a set of steps, or a systematic set of procedures" (van Manen 2014, p. 29), it

can prevent the researcher from carefully considering their work against the tenets of philosophical phenomenology. In consulting various phenomenological texts for guidelines to design this study, I kept Giorgi's (2009) and van Manen's (2014) warnings in the forefront of my mind. In particular, I was wary of applying an interpretive phenomenological methodology like those listed above, as they give the researcher free reign use their own interpretations to make sense of participants' descriptions. Additionally, some of those methods do not provide for the eidetic reduction, and some search for idiographic rather than general meaning. Such practices are inconsistent with transcendental phenomenology and leave greater potential for researcher bias.

e. Ethics

Before beginning data collection, I gained permission from the OU Institutional Review Board (IRB) to conduct a study with human subjects. As part of this process, I obtained approval for my research design, specifically including the study purpose, sampling, interviewing, and data collection and storage strategies. I composed and gained approval for the survey, the interview protocol (Appendix B), scripts that I could use when reaching out to potential informants and participants via phone or email, and scripts that informants could provide to potential participants. I additionally modified the IRB's consent form (Appendix C) to distribute to participants. As described above, upon gaining contact with a potential participant, I informed them of the study purpose and overview and provided them with a copy of the consent form. If they chose to participate, we then worked out scheduling details.

As noted above, I discussed consent again with each participant prior to beginning their interview, and I reiterated both before and after their interview that they

had the freedom to withdraw from any part of the study at any time. In a few cases, I conferred with participants during analysis and prior to writing their narrative summaries about unclear details in their descriptions. I also followed up with each participant at least once post-interview to send them their narrative summaries.

f. Trustworthiness

As covered above in discussion of my epistemological stance, all constructions are reflections rather than exact depictions of reality; thus, in evaluating social research, the focus switches from accuracy (validity) to viability in how well a construction helps one understand the world (Raskin 2002).

> To try to be 'objective' is therefore to pretend that our preconceptions and biases are not influencing our research when they actually are an unavoidable influence on research practice. It is better to acknowledge how our subjective preconceptions and biases shape the research, and to deal with these biases openly and honestly, rather than to pretend they do not exit. (Ezzy 2002, p. 53)

Lincoln and Guba (1985) detailed four criteria to help researchers and readers evaluate the trustworthiness of human studies conducted in natural settings: Credibility, transferability, dependability, and confirmability. Ezzy (2002) adapted Lincoln and Guba's (1985) guidelines for naturalistic inquiry with Athens' (1984) scientific guidelines for qualitative inquiry and added reflexivity to their four criteria.

- Credibility is the accuracy of research findings for study participants. It is enhanced when participants can comment on the truthfulness of qualitative analyses through prolonged observation and member check, and it is also enhanced when the researcher collects data from different sources, i.e., triangulates the data. First, the requirement that participants self-identify as having voluntarily left the atmospheric science occupation ensured that they could describe the experience of interest, and

guarded against my own misrepresentation of their experiences from the start. Prior to interviewing, I spoke at length with the participants via email or phone to discuss my position, research purpose, and interview style; send them the consent form; work out the details of interview scheduling; and learn about their educational and work histories. I made my own, my advisor's, and the OU IRB's contact information available and emphasized that they could contact me at anytime with concerns. Additionally, several participants contacted me in the months since their interviews to see how the study was progressing. At the start of each interview, I spent time building rapport, and I conversed with each participant for at least a half hour after their interviews concluded. I sent each participant their narrative summaries and corresponded via email with 11 of the 14 about their summaries. Sending the participants my writing was motivation to keep the fidelity of their descriptions, as I was fearful of misrepresenting them. This practice also enhanced credibility by empowering the participants to verify that I was describing their experiences clearly and truthfully, without undue over- or under-emphasis, and to give me feedback if I had strayed from their descriptions. Additionally, credibility for a phenomenological study could be considered the accuracy of the findings in describing the phenomenon of interest; this type of credibility is established through the general description of the phenomenon (Osborne 1994).

- Transferability is established when readers can evaluate the applicability of research findings to other contexts. It is supported when the researcher gathers and reports rich, detailed, "thick" description. Dependability is established when the researcher provides enough information and data that the same study could be conducted.

Dependability is not *vis-à-vis* with replication of the results, however, since participants' meanings and interpretations change over time with respect to socio-cultural and historical forces (Ezzy 2002). Phenomenological interviewing goes a long way toward gathering thick descriptions. I have provided demographic, educational, and work information about the participants in Appendix D, and I include many extended excerpts from their interviews in the results (Sec. 3) and in Tables 2, 3, 4, 5, and 6 so that readers may evaluate the veracity of my explication and can consider how the findings could be applied to other contexts, such as future exits from atmospheric science or voluntary turnover from other occupations.

- Confirmability is the degree to which the findings are demonstrably consistent with participants' descriptions and are not the result of researcher bias. The DPPM guards against researcher bias through the *epochè* and the focus on description rather than interpretation. The subjectivity statement (Appendix A) enhances the confirmability of this study by providing readers with a basis to relate myself as research instrument to the study. Sending each participant their narrative summaries for member check enhanced confirmability in that I was motivated to check my work closely against the participants' transcripts and question my explication closely to avoid misrepresenting their experiences. Providing extended quotations throughout this text also enhances the confirmability of the results, in that readers can compare my write-up to the participants' own descriptions.
- Reflexivity is established when the effect of the research methods on the findings are clear. This is established through my detailed discussion of the methodology and

methods, in which I have sought to elaborate the theoretical background and practical steps of the study.

As a final note, participants' descriptions in any retrospective study can be affected by recall bias. However, episodic events appear to be accurately remembered (Wheeler et al. 1997; Symons and Johnson 1997), and voluntary turnover is thought to be episodic in nature (Lee et al. 1999). Maertz and Campion (2004) provided additional memory research to bolster the use of retrospective accounts of turnover. Additionally, Morrell et al. (2004a) and Trevor et al. (2007) pointed out that retrospective accounts are likely the only way to gain complete and valid pictures of the turnover process.

g. Summary of research design

Because the meaning attributed by individuals to the experience of voluntarily exiting the occupation is of foremost interest, I have chosen to structure the research with a descriptive phenomenological research approach—Giorgi's (2009) DPPM—that explicates the psychology of an experience. An exploratory qualitative study of turnover from the atmospheric science occupation is doubly appropriate at this time. First, the topic of exits from the atmospheric science occupation has not been the subject of previous research. Second, traditional quantitative approaches to studying voluntary occupational turnover have failed to adequately explain this phenomenon, and qualitative methods better enable emergence of new information via a constructivist perspective. By designing an exploratory qualitative study, I avoid imposing hypotheses or expectations *a priori* and instead let descriptions and perhaps explanations emerge from data (Lincoln and Guba 1985).

The previous discussion should make it clear that epistemological and theoretical perspectives are close to research design. A personal constructivist epistemology requires that individual meaning-making is illuminated within context. The DPPM is helpful to this study above and beyond other qualitative approaches for several reasons. A descriptive phenomenological methodology like the DPPM reveals individual meaning-making while minimizing the researcher's imposition during data collection and analysis. First, the strict and constant attention to the reduction of researcher bias through bracketing, while necessary in any qualitative method, is especially helpful to a novice researcher. Second, the commitment to broad, open questioning is essential to maintaining the researcher's objectivity by preventing leading questions about a topic of interest. Third, this approach fits the natural science bill of looking for general results while still acknowledging that individuals provide descriptions from within their personal contexts. Fourth, a phenomenological approach is consistent with the emerging constructivist viewpoint in career research, especially with the use of phenomenological approaches to investigate voluntary occupational turnover (e.g., Teixeira and Gomes 2000; Wise and Millward 2005; Amundson et al. 2010; Murtagh et al. 2011; Way 2015; Ahn 2016).

3. Results: The experience of voluntarily exiting the atmospheric science occupation

According to the DPPM, explication culminates in the description of the general structure of the experience of interest. This description relays what it is like for an individual to live the experience of interest and how that experience comes about for them. I present the general structure for the experience of voluntarily exiting the

atmospheric science occupation first, to situate the reader and to ground the following description of the general themes that step through the exit experience. To emphasize the eidetic, psychological nature of the findings, the general structure and themes are presented for an "ideal" leaver, as Giorgi (2009) did in his example explication of the experience of jealousy. Empirical meaning units from the participants' interviews are woven into the descriptions of each theme so that the reader can trace the explication and see how the structure accommodates all of the participants while allowing for intrastructural variability. These and other relevant meaning units are arranged in Appendix E by theme.

a. The general structure of voluntarily exiting the atmospheric science occupation

The experience of voluntary exiting the atmospheric science occupation for the leaver is that of filling a need. As defined by Merriam-Webster (2017), a need can be a necessary duty; a lack of something requisite, desirable, or useful; a condition requiring supply or relief; or a lack of means for subsistence. Needs derive from the leaver's connections with their work, their own selves, and their loved ones. Needs combine and overlap to connect different spheres of the leaver's life and drive the formation of other needs. The leaver articulates their needs and considers how to fill them in relation to their role as worker in the atmospheric science occupation, along with their other roles as parent, partner, friend, hobbyist, student, etc. They find that they cannot fill their needs while staying in the atmospheric science occupation. In order to fill their needs, the leaver exits the atmospheric science occupation.

b. The leaver articulates unfilled needs

The leaver articulates needs that derive from sources within and without the atmospheric science occupation. As a worker in the atmospheric science occupation, the leaver recognizes and makes sense of their needs in relation to working in the occupation.

1) NEEDS DERIVE FROM THE LEAVER'S EXPERIENCES WORKING IN THE ATMOSPHERIC SCIENCE OCCUPATION

The leaver may *need to escape an undesirable work environment* (Appendix E). Working in an undesirable environment can make the leaver feel disheartened, miserable, worn out, rushed, pressured, bothered, frustrated, or stressed, and they may come to hate working in such an environment. Working in an undesirable environment may prompt a "downward spiral" of emotions that negatively impacts extra-work portions of their lives, such as by decreasing their desire to be social, taking up their thoughts outside of work, and diminishing their mental and physical health. The leaver wishes to escape these symptoms of working in an undesirable environment. Nine of the participants described having the need to escape an undesirable work environment. Danny detailed many undesirable aspects of working as a contractor in the public sector, including "petty" disputes with his co-workers, lack of coordination among offices, frustratingly "inefficient" and "wasteful" bureaucracy, and "no atmosphere of advancement." He summed up the effects of working in an undesirable environment on his mental health:

> It wears on you after a while, to where I absolutely hated what I was doing. I would come home in the evenings and not want to go to work in the morning. It's tough, and I don't want to work, I didn't want to work in an environment like that.

Michael listed similar "ugly practices" that "disheartened" him as a contractor in the public sector, as well as his persistent sadness at seeing the lack of jobs available to other talented, qualified atmospheric science graduates. Maggie in particular developed the need to escape an undesirable work environment. In working as a forecaster in the public sector, she learned that she disliked the high-pressure responsibility of issuing severe weather warnings:

> And then I started taking the courses for putting out warnings. It really bothered me because I do not like the idea of having people's lives in my hands. If I screw up on a warning, people could die. And so that really was bothering me. And that actually was a huge decision factor in me not wanting to stay with the public sector, because I did not want to be put in warning situations.

She was not able to escape this concern even outside of her scheduled work hours, since she would be called into the office if there was severe weather, and she began to "dread" severe weather days:

> And so I got to the point where I was dreading severe weather, because if it was my day off, I knew I was going to be called in for it. Where if I was already there, I knew I was going to have to stay late. And I ended up starting to resent the job a little bit, because I didn't want to be there. I wasn't interested in the office aspect of it.

Besides severe weather, she became concerned about the negative mental and physical effects of working overnight shifts:

> And they [other forecasters] were talking about how, when I come off of my mid shifts, I lose days on it because I am adjusting back to a sleep schedule. I just sleep for days. And talking about the toll it takes on their body and their mental outlook on things. And just listening to all that, it was already starting to bother me for a full career in this.

The stress of working in an undesirable environment diminished Maggie's mental and social well-being:

> It got to the point where I was not happy. And since I wasn't happy with my work life, I was not happy in my personal life. I wasn't doing anything. I ended up just staying home all the time. I wouldn't say I was depressed, because I wasn't. I just, I didn't have a social life because I wasn't happy. So it was, I kind of went into a little bit of a downward spiral with it.

She ultimately realized that she needed to escape: "And I just knew that this was not the career that I needed for the rest of my life." In a less stark example, Valerie enjoyed her job tasks a contracted trainer in the public sector; however, after working her job remotely for two years, she desired to escape the temporary nature of remote work and find a permanent workplace:

> I didn't want to do that forever. I was like, I'd like to do something a little more permanent, here in [state], where I can go to work every day.

She also wished to move on from her job because it seemed like a "foot-in-the-door" rather than long-term position where she could root herself.

Humans are inherently social, and the leaver may *need social interaction* with co-workers, friends, family, or others (Appendix E). In particular, they may need more social interaction than their work in the atmospheric science occupation provides or allows for. Job tasks that require focused individual work—such as searching for weather-related media, recording forecasts, or checking the quality of broadcasts—can limit on-the-job social interaction. Additionally, weather requires constant monitoring, and shift work or otherwise nontraditional work schedules can prevent the leaver from socializing outside of work, because they are unable to match their schedules with others' more traditional schedules, or because they are too fatigued to be social. After a time, the leaver realizes that the lack of social interaction decreases their quality of life, and they need more social engagement. Kim and Jacob described this need as stemming

from their nontraditional schedules, which prevented them from spending time outside of work with their friends. Kim explained:

> I needed some more social interaction in my life was the big thing. I worked 1 p.m. to 10 p.m., Thursday, Friday, Saturday, Sunday, Monday. And so I'm out at work when all of my friends are getting together for dinner or what have you. I can't do anything on the weekends because usually I would work a slightly earlier shift, and so I would be gone just the whole day. And so I never really saw anyone. I kept having to turn down invitations to things. So it got to the point where you just stop getting invited because you can never go. People figure out you are never available at the times they do things.

Jacob echoed:

> I was working weekends— That was another big thing. It's amazing. We live in a 24/7 society. If you're stuck working weekends on a full-time job, that's still very tough to deal with, because so much of social life happens on the weekends.

Kim's individualized job tasks also separated her from her co-workers for the entire workday:

> But then on days that there wasn't severe weather, you just sat in your little studio recording for nine hours and then you went home. And so that part started to wear on me, because I consider myself a pretty social person. And there would be a full week where I wouldn't see anyone. Maybe I would see my boss when I came in, but we all sat in our recording studios recording, because there'd be so much work to do, that we wouldn't see each other. We'd send each other emails and that was kind of it. And so you're sitting in this little three-by-three cube with a computer and a microphone for nine hours a day, five days a week.

She described this arrangement as becoming "strained after about a year."

The leaver may *need to do meaningful work* (Appendix E). The leaver defines for himself or herself what is "meaningful" about work. Meaningful work may be challenging, intellectually engaging, spiritually fulfilling, or enjoyable. Through their work, the leaver may need to grow personally or professionally, interact with other "like-minded" people, benefit the world, live out a childhood dream, embrace nature,

feel confident or like an "expert," be recognized by others, utilize their skills, or have time to spend with loved ones or doing enjoyable extra-work activities. The leaver may find that they need more meaningful work than their work in the atmospheric science occupation can provide. Nine of the participants described having the need to do meaningful work. Danny, John, Jacob, and Kim pursued work in atmospheric science to help keep the general public safe by forecasting severe weather. Danny summed up this need: "You want to be able to help and you get into it because you really fundamentally believe that you're doing a really good job." However, their jobs did not allow them to fill this need. For example, Jacob served more often as a producer and researcher than a forecaster, and this decreased his enjoyment of his job:

> But on a daily basis I really wasn't forecasting the weather myself. And so, as far as the job specifically goes, I would say I did not really enjoy it.

John expressed similar complaints about his job, which focused much more on assembling media than on forecasting. Similarly, Kim was not able to forecast as much as she wanted when her company removed her forecasting tools without replacement, and she became frustrated:

> So it got to the point where the second half of the time I was there, we weren't even doing our own forecasting. We were just reading forecasts from the Weather Service. So now, I'm not a meteorologist unless it's summertime. I'm just reading the Weather Service's forecast and calling it a day. So that really started getting to me. I felt like I wasn't doing what I wanted to do, and so it got really frustrating really quickly.

Maggie spoke at length about how she enjoyed working outdoors: "And that's one of the biggest drives for me, is having that opportunity to get out of the office." After graduation, she searched for jobs that would allow her to work outside. She obtained work in another physical science occupation and was able to work outdoors extensively

in that job for several years. However, upon entering the public sector of the atmospheric science occupation, she found that her inability to leave her office during severe weather failed to fill her need:

> And I like to joke that the public sector has it backwards. When severe weather happens, we're the ones that like to be out there watching it. But where are we? Stuck in front of a computer in an office. We don't get to see it. So it's kind of a backward way of thinking about it, because we're the ones that love it and we can't ever see it. So our experience with actually seeing it is, oh, it's coming! Let's see if we can get a glimpse of it out the window before we have to go back in and focus on this. But it's weird with that. But I learned also from that experience of having to go into the office every time severe weather happened: I like to be an observer of it. I like to see it. I don't like to forecast it.

Courtney aspired to be a professor, and she engaged in academic research in graduate school and as a post-doc. As a graduate student, she grew to love teaching while participating in a teaching program that her in a middle school science class, and she developed the need to impact the world through teaching. In particular, she felt that teaching would "make more of a difference" than research:

> I felt like, in the long run, teaching, especially in this area, would make more of a difference. I just felt like it would make more of an impact on the world ultimately in the long run.

Throughout his interview, Xavier spoke passionately about his need for enjoyable, challenging work that engaged him and diversified his skill set. He complained that his time forecasting at two different public sector offices lacked of meaningful work:

> And I was concerned, because a lot of these things very much started to fall into these patterns of, this is going to be an awesome project! You're going to be working on this for months! Oh, wait, not really that much work involved actually.

Xavier was "negatively affected" by seeing "that there wasn't a ton of work to go around" at his offices, and he summarized his fear of being trapped in a career that was

not meaningfully challenging and engaging: "I very much kind of feared myself being stuck in a career where I wasn't (a) enjoying my time and (b) wasn't challenged and continually growing and learning, and in an environment of like-minded people." John and Jacob needed to feel confident about their work, while David needed his manager to recognize their good work. Although David thrived as a private sector forecaster and handled his employer's most high-profile client, his job title and salary did not match his responsibilities. He wished for promotion to a "senior" position that reflected his work, but his managers refused his request for promotion:

> I said, why am I not considered a senior met? They said, you haven't put enough time in. I said, well, they're supposed to be the most important ones. Why aren't they handling these high-profile clients?

He became frustrated by his inability to secure promotion to a senior position.

The leaver may *need security* (Appendix E). Security can come from an adequate salary, stability in one's job or employing organization, or abundant jobs that give the leaver options if they look elsewhere for employment. The leaver may find that working in the atmospheric science occupation does not provide them with sufficient security. Seven of the participants described the need for security. Matthew described himself as "not much of a risk taker." He became fearful for his job security as a contracted trainer in the public sector when his manager warned him and his co-workers about impending budget cuts and the need to lay-off one contracted employee:

> In the spring of 2013, we got an announcement from [boss] that there were going to be some pretty significant funding cuts to the budget. And he said that, more than likely, there would be at least one person that would have to be let go. Now, he was like, I'm not going to say who it's going to be, but we're not necessarily going to be taking seniority into account when we determine who is going to be let go. […] So whenever they had said that the funding was going to be cut and that at least one of us would be let go, and that it wouldn't be

> necessarily based on seniority, I started kind of putting the pieces together and thought about that. I was like, well, I'm the only one that doesn't have a master's degree. Even though I was the most senior member of the junior people that worked there, I didn't have a master's degree. And not once, but twice, [boss] had come around and had wanted to take note of how long we had been at [company] and what our highest level of education was. So that concerned me, that I thought, well, I might be one of the first ones let go, because I didn't have a master's degree.

Michael similarly described himself as a "really risk-averse person." He became uneasy about his job security as a public sector contractor, where politically-driven trends in funding could eliminate his position. Furthermore, he wanted to work in a "growing" occupation with abundant jobs that "has stability and will have a good future." Danny described needing more security for himself and his future family than working as a contractor in the public sector could provide:

> It's great to have a passion, and I've always believed in the idea that if you love what you do, you'll never work a day in your life, which is exactly what I try to do. But again, at the end of the day, you've got to support yourself and your family. And if you can't do that with your passion, you have to move on.

John described staying in his disliked atmospheric science job for many years to provide stability for himself and his family amid the economic instability of the Great Recession: "So the economy's really taking a dump at this point, and I was just like, you know what, I'm just going to keep doing this, because it's stable." Especially over the last three years of his tenure, revenue had "dwindled, dwindled, dwindled," and corporate mergers and budget-driven lay-offs shrunk his department. His job security correspondingly decreased, and he experienced intense strain "waiting for the ax to drop" on his own job.

2) NEEDS DERIVE FROM THE LEAVER'S RELATIONSHIPS WITH LOVED ONES

As social creatures, humans develop ties with other individuals. Relationships with some individuals deepen, and those individuals become loved ones. The leaver's loved ones can include partners, family members, friends, co-workers, pets, or their own selves. Relationships with their loved ones are important to the leaver, and the leaver's needs may stem from these relationships.

The leaver may *need to be physically present with loved ones* (Appendix E). This may require remaining in a certain location with loved ones, or moving to a new location to join loved ones. Seven of the participants described the need to be physically present with loved ones. Linda valued living near parents, and she and her husband wished to move away from her job and closer to their parents in another state. Adam and Valerie's partners served in the military, and they needed to move away from their jobs to follow their partners when the military relocated them to other states. Becky and David's partners gained employment in other states and moved away, while Courtney and her partner maintained a long-distance relationship across several from the start. Although these participants traveled to see their partners regularly while retaining their atmospheric science jobs, they needed to be permanently present with them. Becky summed up the need to live permanently with her partner:

> We had been married for two years. We hadn't seen each other for more than three days a week in [laughs] those two years. […] We wanted to have kids. We wanted to have normal lives where we had a house and it just… Some things have to give somewhere.

The leaver may need to *take care of loved ones* (Appendix E). Taking care of loved ones can include providing for their physical, mental, or spiritual needs by helping them thrive in their work, monitoring their health, providing them with

biological or financial resources, or keeping them safe. Six of the participants described the need to take care of loved ones. Linda and her husband needed to move away from her job to care for his parents:

> He's an only child. His parents are older. I think we both just wanted to move home eventually. […] Initially we were looking to move closer to his parents.

John worked to provide for his family's biological needs:

> I'm doing it because it puts food on my table. It feeds my child. […] Sometimes you just do what you have to do, especially when you have a family.

When John's father-in-law, who was an accountant, passed away, John stepped in to fill his family's financial needs:

> I'm plateau-ed, I'm plateau-ed, I'm plateau-ed. Kind of just dabbling, this, that, and the other. In 2010, my father-in-law dies. He was an accountant. You can kind of see where I'm going here. [laughs] I've been at this kind of plateau for the longest point. Like, all right, what do we do? We don't have anybody that helps— Keep in mind, he handled all the financial decisions for our family. We didn't really have to think about investments. We didn't have to think about retirement stuff, because he would just do it. Some short amount of time passed. We got to the point where, ok, you want to do something new with your life. Weather is pretty much done. The market is so flat for that, you're not going to find any other weather job without sacrificing, having to move to either [city], [other city], something else. And that's not something either of us wanted to do. So we were just like, why not try accounting? It was kind of just one of those things where, why not? I couldn't even tell you exactly how it arose. It just was like, we have this need. Try it, and see if you like it.

He reiterated how he moved into an accounting role to take care of his family:

> I knew nothing, literally nothing, of accounting when I started. I only tried it because it was something out there that was a need.

Although none of the participants described needing to take care of themselves, it seems possible that the leaver may need to care for their own physical, mental, or spiritual health.

The leaver may need to *establish their family* (Appendix E). Linda, Becky, and David described needing to establish families with their spouses and raise children with them. Linda wanted to raise children with her husband, and this played "a big part" in her desire to take on work closer to her parents. Becky also explained how her goals shifted from work to family as she grew older:

> I started seeing more of the family goals. It wasn't so much about what I could do with my job. It was more about what we could do as a family. So that was… It's hard to be a female and do everything. So I think I went more towards the familial part of it than I did towards the job part of it.

Both Becky and David struggled to reconcile their needs to establish their families with their long-distance relationships and shift work, which were not conducive for living with their spouses and raising children with them. David summarized:

> We have my wife and I trying to plan life out together. How are we going to have a family if one of us is always missing for most hours? [laughs] So we're trying to figure things out like that.

3) NEEDS DERIVE FROM GOOD OPPORTUNITIES

The leaver may *need to take a good opportunity* (Appendix E). Good opportunities can develop from job offers, the appearance of financial or other resources, or the awareness of roles that need filling. The leaver may perceive a good opportunity as better than their current work in the atmospheric science occupation, and they may need to take advantage of that opportunity. Eight participants described the need to take a good opportunity. Matthew feared being laid off, and he searched for other jobs both within and outside of the atmospheric science occupation to fill his need for security. He reached out to a professional contact in a business-related occupation,

and she offered him a job. Similarly, Xavier reconnected with an old acquaintance who offered him a job as a software developer with his company:

> And I kind of coincidentally managed to find a connection who I had lost touch with, who was starting a software company back here in [city], which is where I am now. I reached out to him and kind of talked him through my current situation. And in a very different context, he had felt a very similar pull. He was working in finance and there were a lot of parallels between our primary motivations for exiting, and so I think he took a little bit of sympathy with my cause.

Danny began attending graduate school in information technology (IT) in order to diversify his skill set and make it easier to move with his girlfriend. When the system administrator at his organization quit, he applied for her job to gain skills in enjoyable IT work, advance professionally, and escape his immediate undesirable work environment. Although Michael had been searching for forecasting jobs to fill his need for meaningful work, a technical company unexpectedly offered him a job that was "almost too good to be true":

> But gosh, about six months ago, [current company] called me out of the blue. They had a recruiter phone me. And he basically said, you have a really interesting skill set dealing with the government and a strong background, and we want to hire you. So I was like, ok! I don't think I'm interested. And they did what the private sector does, and they basically let me write my own salary, pick what office I wanted to go to, plus paid for all my student loans and everything like that. So, they gave me a really sweet gig.

Courtney also fielded an unexpected job offer from a local science educational center where she volunteered, while Linda and David's parents unexpectedly offered them jobs to work at their family businesses. Linda recounted:

> And then with my parents. They have their own business and their receptionist was basically failing. [laughs] And my mom offered me a position. Come back and work at the office. She was like, why not offer it to one of my children if… Because I believe in them and I know this is an important position. So she offered it to me.

These types of jobs were “pretty ideal” for both Linda and David because they wanted to establish their own families and live near their parents. Kim and Valerie’s friends sent them job postings to help them escape their current positions and find more enjoyable work. Kim’s friend in particular “pestered” her “for at least a year” to quit her disliked job and apply at his company.

Although most of the participants’ good opportunities came in the form of job offers, a better opportunity could involve obtaining child care to alleviate parenting demands or financial resources to leave the workforce or spend more time with loved ones.

4) NEEDS CONNECT DIFFERENT SPHERES OF THE LEAVER’S LIFE

The leaver occupies multiple roles at once. Even if their needs originate in one sphere of their life, or if a single need dominates, their needs spread to connect other spheres and drive other needs. The above interview quotations and other excerpts in Appendix E demonstrate just a few of the many complex ways that needs can interact with and even drive other needs. John’s experience exemplified how the need to take care of loved ones may connect with the need for job security to provide income or the need to take a good opportunity and step into a needed role. Linda and David’s experiences illustrated how the need to establish a family or be physically present with loved ones may connect to the need to take a good opportunity that enables movement to a better geographical location or provides a better schedule. Xavier demonstrated that the need for meaningful work could lead to discontent with their workplace and the need to escape that undesirable environment; Maggie further described how these needs

could spread into non-work lives and diminish social interaction to an unhealthy degree. Becky summed up the spread of needs into different spheres:

> I mean, especially when getting out of meteorology, it's not so much one decision. There's so many things that go into it.

b. The leaver considers how they can fill their needs against the nature of working in the atmospheric science occupation

Unfilled needs create feelings of urgency, discomfort, worry, stress, or unhappiness. The leaver must fill their needs to alleviate such negative feelings. Upon articulating their needs, the leaver considers how to fill them. As a worker in the atmospheric science occupation, the leaver considers filling their needs against the nature of working in the atmospheric science occupation. The nature of working in the atmospheric science occupation is multi-faceted and includes job tasks, workplace culture, supervisor support, and job availability. The leaver's considerations may extend beyond their current atmospheric science job to other jobs within or outside of the atmospheric science occupation. If they are to stay in the workforce, they consider how they can fill their needs while staying in their current atmospheric science job, finding another job in the atmospheric science occupation, or finding work outside of the atmospheric science occupation.

1) THE LEAVER CONSIDERS HOW THEY CAN FILL THEIR NEEDS WHILE STAYING IN THE ATMOSPHERIC SCIENCE OCCUPATION

The leaver considers if they can fill their needs while staying in atmospheric science occupation. Specifically, they may consider if they can: persist with the status

quo; make changes to their current atmospheric science job and/or lifestyle; find a different atmospheric science job; or take a good opportunity.

The leaver may consider if they can fill their needs by *persisting with the status quo*. As Xavier illustrated, this could involve persisting at a job and "just dealing with" unfilled needs, such as the need for more challenging and enjoyable work: "So I considered very seriously just dealing with it." Maggie persisted in her forecasting job as-is for six months in indecision after her crisis hit its peak. Although she could not reconcile her need for outdoor work with her job tasks and work environment, she attributed her persistence to becoming eligible to apply for a promotion. Professional advancement through promotion was meaningful to Maggie, especially since leaving her job to take a job in her previous occupation would require returning to entry-level pay:

> Because now that I am eligible to apply for the next forecaster job, I was really torn. Do I stick with this because I can move up in this? If I go back to my previous occupation, I'm likely going to have to take a pay cut because they're going to want to hire at entry-level.

John persisted at his job for six years after he articulated his needs for greater job security and more meaningful work, weathering three years of budget cuts and lay-offs, in order to provide his family with money, insurance, and other fringe benefits during the economic instability of the Great Recession and its aftermath.

The leaver may consider if they can fill their needs by *making changes to their current atmospheric science job*. Making changes can involve negotiating with supervisors for a raise, promotion, or changes to tasks or schedule. Matthew's professional contact sent him an offer for a higher-paying job at her company. Rather

than accept her offer outright, Matthew attempted to fill his needs to obtain greater security to take a good opportunity by leveraging the offer to negotiate with his manager for a higher salary on his current job. Similarly, David received a job offer from his parents, and he leveraged this offer to negotiate with his managers for promotion to a senior position and a better schedule that would allow him to establish his family. In an effort to escape working with disliked co-workers, Danny worked with his contract manager to change his workload and schedule, and Kim negotiated with her manager to change her job tasks and schedule to enable more social interaction. Making changes may involve negotiating for a change in location. Adam enjoyed his work but needed to be physically present with his wife, and he negotiated with his managers to keep his job remotely when he moved with her to another state. Courtney and her future-husband maintained a long-distance relationship for three years while she finished graduate school, and she was not willing to continue their relationship at a distance post-graduation. To fill her need to be physically present with her partner, she negotiated with her doctoral advisor to work with him as a post-doc remotely when she moved to her partner's city after graduation. Although Valerie anticipated quitting her job to move to another state with her husband, her manager unexpectedly asked her to keep her job and work remotely. Making changes may involve taking on new responsibilities that are more meaningful. Maggie engaged in outreach and mentorship projects offered through her workplace that provided her with enjoyment and personal and professional growth, while Kim took on side projects at work to derive more intellectual engagement than her required job tasks provided. Making changes may also involve avoiding undesired responsibilities, such as how Maggie used her vacation

hours to leave her office and avoid forecasting severe weather. Although none of the participants discussed making changes to the social structures of their workplaces, it seems possible that the leaver could consider spending more time with their co-workers during breaks or planning after-work social events with their co-workers in order to fill the need for more social interaction.

The leaver may consider if they can fill their needs by *finding other work in the atmospheric science occupation*. To do this, they look for and learn about other the availability and characteristics of other atmospheric science jobs through online searches, job postings, professional networks, personal or professional contacts, and their own knowledge of working in the atmospheric science occupation. Michael, Danny, John, Jacob, and Kim were not able to fill their needs to serve the public by forecasting in their current jobs, whether because those jobs required no forecasting at all, or because the forecasting they required did not fully utilize their skills. These participants considered applying for other forecasting jobs to help them fill their needs for meaningful work, and Danny, Jacob, and Kim submitted applications for several forecasting jobs. Danny and John also considered other atmospheric jobs to help them fill their needs to advance professionally, since Danny was "stuck" as a contractor without possibility for promotion, and John's workplace structure was too "flat" for him to promote. Conversely, Maggie needed to escape her job's forecasting requirements, and she identified an interesting outreach-oriented job that she could eventually promote into after making her way through the public sector's forecasting track. To escape the public sector completely and find more meaningful work, Xavier looked for jobs in the private and academic sectors. Although Courtney disliked the tenuous nature

of post-doctoral work and needed to impact the world through science education, she looked for other atmospheric science research jobs to avoid being seen by other atmospheric scientists as part of the "leaky pipeline":

> And I think when I was making this transition, I was really caught up in what other people would think of me for being the leaky pipeline. And that was a huge thing for me. I didn't want people to see me as the leaky pipeline.

Matthew, Linda, Adam, John, Becky, Courtney, and Valerie searched for other atmospheric science jobs in locations that would allow them to fill their needs for desirable, secure, and meaningful work while also staying physically close to or taking care of their loved ones. For example, Matthew restricted his job search to nearby cities so that his wife could continue to progress at her job:

> So I did some initial looking around to see if there were any other jobs open in the area, because by that point my wife was working with [organization] and had gotten a good thing going. And I was like, well, I don't want to look elsewhere necessarily for a meteorology job. […] It wasn't really an option because my wife, she had started her career with [organization] and it was a very, very good job for her. I knew she really enjoyed what she was doing.

Becky applied to public sector forecasting jobs in larger cities where she thought her husband might find a job and they could move together. Courtney looked for atmospheric science post-doctoral positions in her partner's state:

> So that's what I ended up doing. I was geographically restricting myself because I wanted to be near my husband. We weren't married yet, but I wanted to be near him.

The leaver may consider if they can fill their needs by *making changes to their lifestyle*. Becky wished to live with her husband permanently and raise children, but she persisted in her much-loved job for two years rather than making the "awful" decision to quit and move to him. During this time, she and her husband took advantage of

alternation between her rotating shifts and his traditional schedule and drove three-and-a-half hour each way to visit each other "fairly frequently." Becky also attempted to fill her need to establish her family by transforming her co-workers into her "surrogate" family:

> I loved each of them like they were my brothers, like they were my dads, sisters, moms. We had a very close bond.

David and his future-wife's schedules did not line up as well as Becky and her husband's schedules, but they still managed to arrange regular visits for two years while they lived in separate states:

> She would get off work Friday, drive down to where I lived at the time, which is about an hour and 15 minutes, then spend the weekend. Then I when I got off work Sunday afternoon, we would drive up to her city. [laughs] And then she would go to work Monday, Tuesday. I would just stay kind of at the apartment waiting for her to get home. And then Tuesday night or Wednesday morning when she went to work, I'd drive back home.

When they got married, David's wife moved in with him and commuted daily to her work while he retained his job. Even though they now lived together, his non-traditional schedule conflicted with her traditional schedule, and they struggled with how to find the time to establish their family, as noted above. Courtney "lived in fear" about losing funding while she persisted in her post-doctor position for a year after graduation. To alleviate her stress while satisfying her need to educate, Courtney began volunteering at a local science education organization. Although none of the participants mentioned such modifications, it seems possible that, depending on their needs, the leaver could join social groups outside of work, negotiate care for their dependents, take on additional work to supplement income, or pursue other extra-work activities to increase their mental, physical, or spiritual health.

The leaver may consider if they can fill their need to *take a good opportunity* while staying in the atmospheric science occupation. Although none of the participants discussed good opportunities such as financial windfalls or child care, it seems possible that the leaver could take some good opportunities while remaining in the atmospheric science occupation. However, taking a desirable job offer in another occupation could limit their ability to stay in the atmospheric science occupation. Michael, Courtney, and David described either turning down their job offers to stay in the atmospheric science occupation or accepting them and leaving the occupation. In particular, Courtney described this choice as "excruciating" because of how quickly she had to make a final decision:

> But partially, I think why the job choice was so excruciating is because I felt like I had to make this choice right now. Like, jump off the train or not. And once you jump off, you can't get back on.

2) THE LEAVER CONSIDERS HOW THEY CAN FILL THEIR NEEDS BY LEAVING THE ATMOSPHERIC SCIENCE OCCUPATION

The leaver may consider if they can fill their needs by leaving the atmospheric science occupation. They could accomplish this by finding work in another occupation or by leaving the workforce entirely. Six of the participants described actively considering if they could fill their needs by finding work outside of the atmospheric science occupation. Matthew feared being laid off, and in order to fill his need for security, he reached out to a contact in the business occupation to see if her company would consider his transferrable skills and hire him. Linda was confident her well-rounded skill set, which she had built up through being promoted to four different positions at her private sector company, would open up many other jobs outside of the

atmospheric science occupation that would allow her to fill her needs to move closer to parents and establish a family with her husband: "I felt like I could do a lot of different things if I wanted to in my hometown or in my husband's hometown." She felt "neutral" about staying in the atmospheric science occupation, while she in contrast felt excited and happy about moving closer to family and having the resources to have children:

> I was pretty neutral. The excitement was more moving to home. I was indifferent on the job that I got as long as I enjoyed it.

Danny wanted his girlfriend to succeed in her occupation, and he anticipated moving closer to her in the near future: "I would be more than happy to follow her to wherever her degree takes her." Because jobs in both of their occupations were geographically restricted, he felt that he would have better luck moving with her to a place she could thrive if he was working in another occupation with more job options. He had a longtime interest in computing, and he prepared to fill his need to be physically present with his girlfriend by entering graduate school for a master's degree to help him obtain an IT job near his girlfriend:

> My girlfriend got her degree in [discipline], and there's a limited number of jobs geographically that she could excel at. Her career options are tied to specific places. And the thought process was, the chances of her getting a job in her field and me getting a job in my field that were in the same place was so incredibly low, it wasn't going to happen. And so having a passion for IT anyway, it just seemed like the right time to go ahead and bite the bullet and start going down that path.

John pursued an accounting degree to support his family's needs and eventually escape his undesirable work environment while continuing to work full-time in his private sector job. Maggie had enjoyed her time working in another physical science

occupation. After pausing for about six months to weigh her decision, she began searching for jobs in her previous occupation:

> So about November, I was like, I don't think I'm going to stay here. And then by April to June of the next year, I'm like, yeah, I'm not staying here. I'm actively looking for another job now.

Valerie described her job security as a public sector contractor as "always a bit tenuous." While working at her job remotely, she continually searched for other jobs in order to fill her need for security along with her needs to move to her partner and find permanent work:

> So my whole time at my organization, I was always looking for a job, because I knew that my job could go away at any minute. And plus, I didn't want to do that forever. I was like, I'd like to do something a little more permanent, here in [state], where I can go to work every day.

She enjoyed the possibility of trying out work in a different occupation, and so she searched for jobs in the financial, business, and technical occupations as well as the atmospheric science occupation in her husband's new city:

> But the prospect of being able to choose something different… I mean, I looked into some crazy stuff.

Although none of the participants considered filling their needs by leaving the workforce, it seems possible that they could consider options such as becoming a stay-at-home parent, taking a temporary leave from work, or retiring.

c. The leaver finds that they cannot fill their needs while staying in the atmospheric science occupation

As the leaver considers how to fill their needs, they find that the nature of working in the atmospheric science occupation prevents them from filling their needs

while staying in the occupation. This can be due to the nature of working in their current atmospheric science job or in other atmospheric science jobs.

1) THE LEAVER CANNOT FILL THEIR NEEDS WHILE STAYING IN THEIR CURRENT ATMOSPHERIC SCIENCE JOB

The leaver finds that they cannot fill their needs while staying in their current atmospheric science job. They may be unable to fill their needs by persisting with the status quo; they may be unable to make sufficient changes to their work or personal lives; or they may be unable to take advantage of a good opportunity while continuing in their job.

The leaver finds that they cannot fill their needs while staying in their current atmospheric science job because they *cannot persist with the status quo*. Xavier's resolve to persist in his job failed quickly, as he saw no sense in staying in an unenjoyable job:

> So I considered very seriously just dealing with it. And that only lasted for a few days [laughs] because there's no sense in kind of being stuck in a career that I just did not enjoy.

His need to escape became overwhelming and motivated him to quit his job:

> It was overwhelmingly, the sensation was, I don't want to be here 30 years down the road, checking Facebook at four o'clock in the morning on a Friday night because I'm working an overnight shift and there's no forecast to do. That was motivating enough for me to just say, I need to quit.

Maggie needed to escape forecasting rather than spend years promoting through forecasting jobs in order to attempt to advance into a more desirable outreach-oriented position, and she applied for jobs in her previous, preferred occupation instead. Matthew was unwilling risk staying with his job when he had "all indications" that he

would be laid-off: “And so then I was like, well, I’d rather at least have some job and make this move voluntarily than risk being the one let go and saying, now what do I do?” A few months before he quit, John’s boss informed him that his department would be next in line for lay-offs: “So we’re just going to let you know that, at some point down the road, there’s going to be cuts, and you’re next.” John feared for his job security too much to risk staying at his job any longer, and he frantically applied for accounting jobs:

> I look back on that summer, and it’s the worst summer ever. So imagine, so just think of this. I’ve got a two-and-a-half year old. I’ve got a baby on the way. I’m going to be losing my job, and I have no experience in my new degree. I am fucked. [laughs] I am just screwed beyond belief. So all I do is, I hit as many possible openings for an entry-level accountant as I possibly can. That whole summer, that’s all I did.

Courtney could not continue living with the fear that her advisor would cut off her post-doctoral funding, and she applied to other atmospheric science research jobs. Valerie’s employing organization cut funding for remote work, and at that point, she “didn’t really have a choice” other than to look for other jobs to fill her needs.

The leaver may not be able to fill their needs while staying in their current atmospheric science job because they *cannot make sufficient changes to their job*. They may be unable to enact sufficient changes because the type of work that their job requires is incompatible with their needs. Although Kim attempted to work on side projects in her spare time, she realized that they did not fulfill her needs for more meaningful work or social interaction:

> But I’d just sit in this little box, doing these projects, and that was… It only did so much for me before it kind of became apparent that, to me at least, it wasn’t ever really going to change.

Eventually, her unfilled needs, especially for social interaction, became overwhelming: "But it just got to be too much for me after a while. It was just too anti-social." The leaver may not be able to enact sufficient changes because their superiors will not acquiesce to their desired changes. Kim's manager would not change her work tasks because they were inherent to the job:

> For the most part, if you brought it up to our chief operating officer, it was kind of like, well, this is what our company is. I don't know what else to give you, because this is what we do.

Similarly, David's managers denied his requests to be promoted to a senior position and "wouldn't budge" on his schedule. Adam at first successfully negotiated to keep his job remotely, but "after a few months, that ceased to be a viable option" when his company discontinued remote work for their employees.

The leaver may not be able to fill their needs while staying in their current atmospheric science job because they *cannot make sufficient changes to their lifestyle*. Becky and her husband maintained their marriage long-distance for two years by commuting three-and-a-half hours each way for regular visits, but this arrangement "wasn't sustainable" for her in the long-term, both because the commute exhausted her and because the distance prevented her from filling her need to raise children with her husband. She became acutely aware of the lack of sustainability as a "compilation of little things" added up, such as her unease at coming home in the dark after working overnight shifts, the difficulty of being with her husband during medical events, and pressure from her parents to have a more traditional marriage. Becky summed the unsustainable nature of their lifestyle: "Some things have to give somewhere, and it just

happened to be my job." Because her husband had already moved once to follow Becky to her job, she determined that it was her "turn" to move for him:

> He wasn't going to move back up to be in the city, because he had a good thing going. We didn't really need the money. We didn't really have anything else going. And I think like I said before, he had moved to [state] for me. It was just kind of my turn to suck it up and do the same for him.

Similarly, David and his wife attempted to fit their schedules together, but they were unable to establish their family as they wanted:

> Sometimes we talk about, could it have worked? It could have, but when you're thinking about trying to plan your future, you want to go for what you think will work the best, not what could work. Our relationship is one that we could've made just about anything work. But did we want to just make it work? Or did we want it to be what we wanted?

The leaver may not be able to sufficiently modify their outlook. Danny successfully worked with his contract manager to change his workload and schedule, but this failed to help him fill his needs to escape an undesirable work environment and do meaningful work:

> And we tried a couple of different things and it just didn't change. I was just always unhappy.

The leaver may be *unable to fill their need to take a good opportunity* while staying at their current atmospheric science job. The participants with job offers in hand had to choose either their current job or a new job, and they felt that the other jobs would satisfy their needs between than their current jobs. For example, Michael did not wish to risk staying in his insecure, somewhat undesirable job when he had a good job offer in hand:

> And so that was one thing where I was like, ok, this offer's almost too good to be true. So I have that on one hand. Then on the other hand, if I say no to [current company], am I going to get, is training going to get cut again in

> another year or two, depending on how 2016 goes? The election? And so there was the uncertainty. I'm just a really risk-averse person.

After Kim was unable to make changes to her job, she applied for a job her friend had "pestered" her about at his company:

> I wasn't really optimistic. I kind of was just so frustrated with the job that I just went, ok, fine. So I touched my resume up, threw it at the contracting company, and I got a job offer about two months after that.

2) THE LEAVER MAY BE UNABLE TO IDENTIFY OTHER AVAILABLE JOBS IN THE ATMOSPHERIC SCIENCE OCCUPATION THAT WOULD ENABLE THEM TO FILL THEIR NEEDS

The leaver may be unable to identify other available atmospheric science jobs that would enable them to fill their needs. The leaver defines for himself or herself what characteristics make a job "available." An available job could be currently open and accepting applications. It could require educational degrees, work experience, or skills that the leaver has. It could be located in a geographic area that is attainable or desirable to the leaver. It could have a workplace environment, schedule, salary, or tasks that would enable the leaver to fill their needs.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to a *lack of hiring* (Appendix E). A lack of hiring inhibits the leaver's ability to locate gainful employment in the atmospheric science occupation, due to a lack of job openings or a lack of response to their applications. Although Adam moved to a large metropolitan area with several atmospheric science companies, he said:

> It didn't seem like anyone was actually hiring at the time, which didn't help. So timing was a factor.

Danny applied to forecasting and training positions in the public sector but received no feedback:

> And that's what was really frustrating is, I wasn't hearing anything back. I wasn't getting interviews. I wasn't getting rejection letters. It was just radio silence. I'd send resumes out and fill out applications and they would just disappear.

He partially blamed his lack of feedback on the "closed" state of public sector hiring: "The public sector meteorologist market is so closed, it's not even funny." Jacob attempted to apply to both public and private sector jobs but was limited by the lack of open positions: "So I did continue to apply for jobs, but admittedly, I wasn't applying for many, because frankly, I didn't see that many opportunities come across my way." Courtney struggled to find other research positions at a time when funding for science research in general was low:

> And so that and the whole funding thing was just— Because right at the time I graduated it was just like, there's no funding for anybody to do anything.

The atmospheric science occupation is a relatively small occupation with few total jobs. The leaver may be unable to identify available jobs in the atmospheric science occupation due to an *overall lack of jobs* (Appendix E). An overall lack of jobs can be related to the smallness of the atmospheric science occupation compared with other occupations. Adam summed up this difficulty: "It's a small field. It's challenging trying to find employment." He illustrated the smallness of the atmospheric science occupation by contrasting it to larger occupations:

> I think any field as small as meteorology tends to be, you would have the same problem. But there are other fields like generic software development, not targeted to any one area. Teaching, the medical profession: anything like that is pretty much available anywhere. You would have less of a problem staying in your field. Meteorology is so niche that it's just difficult to stay in it I think.

Similarly, Jacob contrasted the number of atmospheric science jobs with the abundance of jobs in other occupations:

> It's really tough to look at someone who's a nurse or a programmer or an engineer: these truly in-demand careers where they can pretty much get a job wherever they want. It's really tough to look at them and see those people with so many opportunities, and then see me with so few. It's tough.

An overall lack of jobs also can be related to low demand for atmospheric scientists, which leads to a lack of opportunities for employment within the occupation. Jacob referenced numbers to illustrate the lack of opportunities:

> So it just kind of became, before college, I thought there were X number of jobs in meteorology available. And then after college, I realized it was Y number of jobs, which is significantly smaller than X.

He further explained that the overall lack of jobs was exacerbated when combined with other limitations on availability:

> And then I kind of just continued to whittle away: Well, I don't want to do that. I can't do that. And that's not going to happen. So the amount of available jobs has significantly diminished.

David referenced corporate mergers and buyouts as shrinking the number of private sector jobs and decreasing the number of opportunities:

> And especially, too, it seems like the private sector, those acquisitions by bigger hands and stuff, it's getting smaller, and there's not always those opportunities. You yourself heard about the dissolving of [private weather company], and I think [other private weather company] was just before that. There's not as many of those spots to go around as there used to be.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to *prohibitive competition* (Appendix E). Competition may limit the leaver's ability to identify available jobs by limiting their ability to find available atmospheric science jobs or be hired for them. Competition is enhanced when there are

more degree-holding atmospheric scientists searching for and applying to jobs compared with the number of workers demanded, or when individuals with less educational attainment or experience must compete with others who have more education or experience. It may be enhanced by economic instability that limits job growth. After Adam's wife left the military, he chose to move their family to another city in large part because it had many atmospheric science organizations. However, he found that competition for jobs was fierce, even for entry-level jobs: "As I understand it, you have people with a Ph.D. applying for entry-level positions." Courtney knew that leaving her post-doctoral position and turning down other academic positions would prevent her from publishing. Because competition for research funding was vigorous, a lack of publications would effectively prevent her from obtaining other academic jobs in the future:

> And I had absolutely no illusions with the way the funding is going. I can't see that there's any way I could get back into the field, now that I've had a couple years of no publications. And I knew that going into it. But partially, I think why the job choice was so excruciating is because I felt like I had to make this choice right now. Like, jump off the train or not. And once you jump off, you can't get back on. And that was where I made that decision from, and it was horrible. It was really, really horrible.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to their *insufficient educational background* (Appendix E). It is common for atmospheric science jobs to formally require at least a bachelor's degree, and some jobs may require graduate degrees. Adam's quote in the previous paragraph illustrates that competition can drive informal educational requirements, such as through an oversupply of highly-degreed graduates that are searching for jobs. Danny described his inability to find a job due to his lack of an atmospheric science master's degree:

> I was incredibly ill-prepared to go into the job market. And I don't blame my professors for that or any of my friends or anything. I blame myself for that. I should've done more research in my junior year going into my senior year to determine that in order to even have a chance at having a forecasting job, I had to have a master's. That's just the climate that they progressed into.

Jacob and Kim also terminated their atmospheric science educations with bachelor's degrees, and they noted that most of the job postings they found, especially those in the public sector, required that applicants hold atmospheric science graduate degrees.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to their *insufficient skill set* (Appendix E). Atmospheric science jobs may require experience with specific technology. Programming requirements closed off many jobs from Matthew, who was an intermediate programmer and did not have interest in learning more:

> There wasn't really much. For one, meteorology had become so heavily dependent upon computer programming. I would consider myself an intermediate person with regard to HTML. I tried to proactively teach myself Java and Flash. But I just never really had a knack for it. So I knew that was going to be limiting my abilities to be able to get a job with, say, a research organization or even with a private company. So I knew it was just going to end up being really, really hard for me to be able to stay in my area with basically a rather limited skill set in terms of what I found were my interests.

Even though Adam enjoyed programming and had extensive computing experience, specific computing requirements prevented him from finding another atmospheric science job:

> The jobs that I was seeing tended to involve clustered systems. This is again one of those things where early experiences shape what happens down the road. Because I worked with [research topic description], I never had the opportunity to use the supercomputer and get experience doing things like MPI development for multi-processor environments and whatnot. And so now, even if I wanted to jump into a job at [local research organization], a lot of them require MPI experience and various other things, and you can't really gain experience in those things on your own. You need to have access to a supercomputer or

> something along those lines. So, there are things earlier on that sort of made it difficult to try to get back into meteorology as well.

Atmospheric science jobs also can require extensive or continuous on-the-job forecasting experience. Danny, Kim, and Valerie noted that being out of the occupation for any length of time inhibited their abilities to find jobs, since technology changed so quickly and they feared that their confidence in their skills would rust with disuse. Although none of the participants were interested in broadcast meteorology, it seems possible that requirements for speaking ability or on-camera experience could prevent the leaver from finding broadcast-related jobs. Atmospheric science jobs also can informally require attitudes like enthusiasm and passion. Jacob felt that if he "was truly passionate for meteorology," he "would find a way to get a job." Valerie explained that competition among many enthusiastic graduates had created the requirement for "passion," which she did not have and which limited her ability to obtain another atmospheric science job.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to a *lack of geographically-available jobs* (Appendix E). They may be unable to find jobs in their current geographic area. Matthew needed to find another job nearby to provide for his wife's continued professional advancement, but there were no open atmospheric science jobs in his area. Adam similarly found that there "wasn't really anything to be had" in the first city he and his wife moved to. Although they later moved to a large metropolitan area that housed several atmospheric science companies, the commute to those companies was prohibitive:

> Now, there should have been a lot of meteorology-related stuff in that general area. But where we were living made it difficult. Because anything in [city] or—

> Let's say [private weather company] was out there, but they were out in [suburb], which was prohibitively far away for me to have really considered.

Similarly, Becky's husband's state held two public sector offices, but the commute was prohibitive:

> The closest office was [city] or [other city] and they were both two hours away. And that was completely off the table. There's no way I was commuting two hours to and from work.

Linda needed to live closer to her family but there were no atmospheric science companies near their small town:

> Maybe if I was from a big city that would've been fine. But not from real small-town U.S.A. was I going to find a job there.

Courtney restricted her job search to her husband's geographic area, where there were "just not a whole lot of options," especially when funding was low. She even turned down two atmospheric science job offers in other states to avoid going back to a long-distance relationship: "Because after three years of long-distance, I couldn't imagine going back to that." Kim did not make enough money to pay for moving costs, and so she looked for atmospheric science jobs locally:

> I did not have money to move. I didn't have the means to move very far. So I was just looking around where I could.

She identified only one other local company but elected to avoid it due to its bad reputation. John restricted his job search to support both his and his wife's geographic preferences. He determined that, due to stagnation of the atmospheric science job market, atmospheric science jobs were concentrated in locations that were undesirable to him:

> Weather is pretty much done. The market is so flat for that, you're not going to find any other weather job without sacrificing, having to move to either [city], [other city], something else. And that's not something either of us wanted to do.

Valerie corresponded with managers at an appealing job in an adjacent state that would allow her to combine her interests in training and meteorology. She requested to work remotely, but they would not allow it:

> So I was like, can I work from home? They're like, no, you really can't do this from home. And they were like, what if you just came to [state] Monday through Friday and then went home on the weekends? [laughs] I was like, oh, a seven-and-a-half hour drive. [laughs] And I have to go through [city] each way. No thanks. And also I had to be away from my husband for most of the week. I'm like, well, what's the point?

The leaver may be unable to identify available atmospheric science jobs to fill their needs due to a *lack of appealing jobs* (Appendix E). They may note a prevalence of unappealing jobs. For example, Michael, Danny, Maggie, and Xavier extended their complaints about their current public sector jobs to other public sector jobs and viewed them as unappealing. Michael lamented recent changes in the public sector:

> And then the public sector is always kind of where I wanted to be, but then getting into [organization], I realized that in those just couple of years that I was gone and in grad school, removed me from how things were going. Things have really rapidly changed, and I don't think for the better.

Changes especially to scheduling, hiring, and training practices made public sector jobs unappealing to him:

> It destroys the culture. And so that was the other big thing where I'm just like, I don't know if I want to be part of this now, because the public sector is just going through too many growing pains.

Danny's experience as a contractor and his inability to receive feedback to his job applications showed him that he would not be able to fill his need to advance professionally in the public sector: "It didn't have the career prospects I was looking

for." Additionally, these participants did not expect work in the public sector to improve and become more appealing. For example, Xavier needed to escape because bureaucracy prevented public sector work environments from improving:

> And so when I ended up quitting, I ended up kind of sharing this similar story and [laughs] was met with a mixed bag of, we totally agree. A lot of what you're saying is valid and true. Unfortunately, a lot of these things can't really be changed because of the way that the workers' unions are established and the way that the government has structured how we get funding and all of these things. And it was kind of like, yeah, I know. That's why I'm leaving.

He added:

> The reason the public sector is in the state that it is in is because it's so unpleasant for people like me to be in it. And the people like me who are finding this place very unpleasant are the people who should be involved in getting it changed, to encourage much more of that type of mindset. So it was like, the irony of the reason. The reason that I'm leaving is because there aren't enough people who are motivated enough like myself to change it.

In talking with his friend who worked at a private weather company, Xavier also saw a similar lack of appealing jobs in the private sector. Kim and David noted that the constant supply of new graduates allowed private sector companies to sustain unappealing environments. Kim described such jobs as "chewing up" aspiring atmospheric scientists, and David described a "next person up" mentality:

> I think sometimes they let the way it is lag, but on the employees. […] So sometimes I think because of that, there's always the, well, if you don't like it, you can leave, and if you leave, then I can get someone in who's fresh out of the box and start them back in that low number.

The leaver may note a lack of appealing jobs. Jacob specified that a lack of mid-level jobs prevented his growth:

> I think there's kind of a disconnect. I think there's entry-level, basic-level jobs for meteorologists, and then there's the higher stuff. I don't know how much middle ground there is.

Valerie wished to blend her interests in training and development and meteorology, but she noted that the organization where she had already worked as a trainer was "the only real opportunity for that."

The leaver may be unable to identify available jobs in the atmospheric science occupation due to a *lack of secure jobs* (Appendix E). Several of the participants noted the undesirable nature of contract work. Adam had moved to a city with an abundance of atmospheric science organizations and companies, but he disliked the temporary nature of many of the interesting research jobs:

> Especially stuff in this area tends to be sort of timed. I'm trying to think of how to put that one. Timed contracts, a year or two. And then you're back in a position of, am I going to have a job in two years?

Courtney lamented that a lack of funding "for anybody to do anything" made finding a secure atmospheric science research job difficult.

The leaver may be unable to identify available jobs in the atmospheric science occupation due to a *lack of well-paying jobs* (Appendix E). A job may pay too little for the leaver to satisfactorily provide for their needs, and if the leaver finds jobs with better pay, this difficulty can be enhanced. Matthew was unwilling to take a pay cut to return to an entry-level job with his previous employer. Adam's desire to apply for interesting atmospheric science jobs was tempered by their lower pay:

> Software development, compensation-wise, is, as I have found, much more lucrative than meteorology jobs. So my desire to get back into meteorology, while it is somewhat strong, isn't strong enough to take a major pay cut to do it, if that makes sense.

Jacob "could not afford" to take a pay cut to find a broadcast meteorologist job:

> Could I get a, a small market TV job? Maybe I could. I would like to think I could. But that would probably also at this point mean a significant pay cut from

> an already relatively low salary. I'm not willing and, frankly, I don't think I could afford to make.

The leaver may be unable to identify available jobs in the atmospheric science occupation that would allow them to fill their needs due to a *lack of fit with life demands* (Appendix E). The demands can include responsibilities, such as raising children or taking care of pets. As a public sector forecaster, Maggie would be unable to ensure that she was able to stay with her pets during severe weather, since she would be called in to work. Becky's husband worried that their distance prevented him from keeping tabs on her safety and health, and the "little things" that concerned them added up and became "not sustainable." She additionally worried about "juggling" the responsibilities of being a parent while doing shift work as a public sector forecaster.

The leaver may be unable to identify available jobs in the atmospheric science occupation that would allow them to fill their need to *take a good opportunity*. This especially may be the case if a good opportunity has an expiration date, such as a job offer that requires prompt response. Danny was unwilling to pass up the system's administrator position that opened up unexpectedly at his facility in favor of continuing to look for other atmospheric science jobs: "It didn't have the career prospects I was looking for, whereas IT, at least in this area, really does." He added: "Everybody needs an IT guy." Courtney obtained three job offers simultaneously, and she had to decide quickly whether or not to accept one of the two jobs in the academic sector of the atmospheric science occupation or accept the job with the science education where she volunteered. She described her decision as "torture":

> And that was where I made that decision from, and it was horrible. It was really, really horrible. There was an article that came out recently, I think in *Nature*,

> about the emotional side of leaving academia. And this was two weeks ago, three weeks ago. And this article came out, and I read this article and I literally started crying at my desk, because it talked about all of these emotional— The turmoil that I went through trying to make this decision.

Valerie applied to the jobs her friend sent her and received offers from both. She was especially excited about the offer from a well-reviewed technical company, and she needed to take that opportunity rather than continue to look for atmospheric science jobs: "And I didn't want to turn down an opportunity to work at [company]."

d. The leaver exits the atmospheric science occupation in order to fill their needs

Since the leaver has found that they cannot fill their needs while staying in the atmospheric science occupation, they exit it. Their exit involves a visible break from the atmospheric science occupation when they take work in another in another occupation or leave the workforce, and it involves an invisible, internal break as they mentally cope with their exits.

The leaver's exit is made visible when they take work in another occupation or leave the workforce entirely. Matthew accepted his professional contact's offer to work remotely for her company as a system administrator, Linda accepted her parents' offer to work for their family business, and Michael took his "sweet" job offer to work as a software engineer: "I'm just a really risk-averse person and so it was like, well, nothing is taking away what I already know about the public sector, so I took the job with the intention of kind of keeping my eye on things and seeing if maybe there's a place for me in the future." When his employer discontinued remote work, Adam quit in order to stay with his wife. Although he continued to look for atmospheric science jobs, headhunters recruited him extensively for technical jobs, and he eventually accepted

one of their offers to work in software development. Danny obtained the open system administrator position at his same facility:

> I took the opportunity to move into her position because it offered more opportunity to me in the area. As a contractor, there's little to no room for promotion. You kind of get stuck where you're at. And I was getting tired of a lot of the politics that were going on within the weather side of things. So I took the opportunity to move into IT at the same facility.

Two months after he began his search for accounting jobs, John received and accepted an offer and quit his private sector atmospheric science job the next day. Maggie spent two years applying for a specific type of job in another occupation. At the time of the interview, she had just mailed her formal acceptance to a job offer to reenter her previous occupation; when I restarted correspondence to send her narrative summary, she had been working the new job for several months. Becky's husband introduced her to his colleagues, and she parlayed her critical thinking and data analysis skills into a project management position with his company. Courtney turned down both research job offers and accepted the full-time job at her science education center. Xavier accepted his acquaintance's job offer to work as a software developer. Jacob had kept a part-time job at a local radio station since he graduated college, and he worked with his manager to transition his part-time job into a full-time job. Kim accepted the job offer at her friend's company, and Valerie accepted work at the companies her friend had told her about. David was not willing to delay establishing his family any longer, and so he quit his job in order to accept in parents' offer to work for their family business:

> And so then I told them, I really enjoy working here. This is the best job ever, but we're trying to build our future, and here's my two weeks.

Although none of the participants filled their needs by exiting the workforce, it seems possible that the leaver could take advantage of the opportunity to retire from the workforce, temporarily or permanently, if financial or other resources allow them to do so and fill their needs that way.

The leaver's exit involves an internal break with the atmospheric science occupation. Breaking with an occupation that required years of mental, financial, temporal, and emotional investment can be difficult for the leaver. In self-reporting that they had voluntarily exited the atmospheric science occupation, the participants indicated that they subjectively felt that they had broken from the occupation. Michael, Danny, Jacob, and Kim described feeling like they had "wasted" their time, "given up" on atmospheric science, and "failed" in their pursuit of the occupation. Kim summarized this outlook:

> That was not an easy choice, because I killed myself for five years to get that degree. And so I very much fought with the feeling of, how much money did I just spend on this piece of paper? How much time and effort did I put into it? And I'm leaving it? Really? I fought with that a lot, because it did feel like kind of giving up in a sense. And also going into this new job where I had no idea what I was getting myself into and felt absolutely terrified going in there. And so the whole thing all around was just completely [laughs] insane. There were lots and lots of emotions, but the biggest was one feeling like I was giving up on meteorology. Giving up on something that I had been focused on for 10 years. And that was really hard to deal with.

Danny and Jacob described their exits as the end of a chance. Danny said: "I gave the meteorology thing a chance. It just wasn't moving." Jacob elaborated:

> At that point I'd kind of known that a career in meteorology was going to be a lot harder to get than I thought it was. And so, I think at that time I was maybe realizing that— Certainly not to give up on meteorology, but that I maybe needed to start considering other options, because all my life, I'd wanted to be a meteorologist, and now here I was. I had my chance and now, maybe there's not

> going to be another opportunity, or certainly not an opportunity in the near future.

John his exit as the "right" choice for his security despite his desire to stay in the atmospheric science occupation:

> I didn't leave because I wanted to. I left because I had to. I left because they were going to kill me off anyway. But I didn't leave weather because I wanted to. I left weather because it was the right thing to do.

Jacob felt like he had failed in his pursuit of work in the atmospheric science occupation, but he also felt relief:

> I did feel like I failed, but I also was— At that point, it didn't matter to me, because I was just so relieved that I was quitting, that I was going to be done.

He, Courtney, and David also described feeling like they no longer knew what they would do with their future careers. Courtney compared her exit to the loss of a road map:

> When you want to be tenured faculty, there's the quote-unquote road map that you have to follow that everybody follows. And it's this path, and everybody knows, oh, ok, well now I've defended, now I'm going to do a post-doc, then I'll do another one, then I'll do another one. Then I'll be faculty somewhere. And I think with this transition, I just had no idea what was going to happen. And that was, that was really hard [chuckles] for me. Not having a set career path was incredibly difficult. It's been really hard to wrap my head around that.

4. Results: The participants evaluate their exits

As noted in Sec. 1, phenomenological questions and explication focus on experience, not on participants' evaluations of hypothetical scenarios. Nevertheless, those atmospheric scientists who may be interested in applying the results of this study to ensure the health of the occupation may wish to know how the participants evaluated their exits. To this end, I also asked the participants: Were your exits avoidable? Were

they typical? Would you return? I used structural coding (Saldana 2009) to analyze their responses, and I present my analysis here.

a. Were their exits avoidable?

I asked the participants if there was anything that could have happened at the time of their exits to prevent them from leaving the atmospheric science occupation. For the 10 participants who thought this question was relevant to their experiences, nine described at least one way that their exits could have been avoided, while 10 described at least one factor that made their exits unavoidable (Appendix F). This overlap suggests that avoidability was a complicated issue for the participants: The imagined circumstances that could have helped them avoid their exits were tempered by what they had actually experienced, and many participants felt that the circumstances they imagined that could have helped them avoid their exits ere unrealistic and unlikely.

Six participants imagined that they might have avoided exiting the atmospheric science occupation if the nature of their work had changed in ways that would have allowed them to fill their needs (Appendix F). Matthew and Michael exited the occupation to fill their needs for security. They both imagined that they might have stayed if they had had greater guarantee of job security and stability in their employing organizations, but no guarantees were available at the time. Matthew added that he might have chanced staying at his job had he not received his professional contact's job offer. Jacob speculated that he might have stayed if his company had provided their employees with work mentors and lightened his workload, since he may have felt less pressure to rush through his work and more confident in it. However, his workplace was not set up to provide their employees with mentors, and although his manager did

lighten his workload after he put in his one-month notice, the job tasks still were too mundane. Because of the intrinsically mundane nature of his job tasks, he did not think that his exit was realistically avoidable: "But in that specific position, I don't know if there's anything that really could've been done to keep me." Courtney wondered if she would have had a better chance of finding available atmospheric science jobs near her husband if her advisor had introduced her to professional contacts while she was in graduate school:

> The way I thought things were kind of going to work out differently is that I kind of expected— For some of the other students in my research group, my advisor kind of introduced them around and helped them make connections that he anticipated would help them find a job. And he never really did that for me. And I always kind of wondered, if he had… I mean, imagine yourself at AGU, and all the big-name people, they don't really talk to grad students [laughs] unless they're specifically introduced. I always kind of wondered if maybe things would've worked out differently if he had kind of bothered to do that a little more.

Since this did not happen, she did not see that she realistically could have avoided exiting the occupation. Kim imagined that she might have stayed in her job if her company had made "radical changes" to the schedules that would allow her to have more social interaction outside of work, as well as changes to their forecasting tools to enable her to use her forecasting skills. However, since her manager was unwilling to change her schedule or tasks, and her company never replaced her forecasting tools, she did not see that her exit was realistically avoidable. David imagined that he might have stayed if his managers had changed his schedule. However, his employers repeatedly told him that they were unwilling to modify his schedule for even the part of the year where his forecasting responsibilities would have been less. In order to establish his family in the best possible way, David was forced to exit.

Two of the participants described how the difficult state of the atmospheric science job market contributed to the unavoidability of their exits (Appendix F). The job market prevented Adam from moving with his wife while also staying in the atmospheric science occupation:

> If the job market had allowed me to stay in, I would have willingly. In my case, it didn't though.

Becky imagined that finding nearby jobs might have prevented her exit: "Had I gotten a job in [closer southern city] or [other closer southern city] I think it may have been different." However, the aftermath of the Great Recession closed those jobs, and even if they had been open, she thinks the two-hour commute to and from work would have been prohibitive and she would not have realistically taken either job.

A couple of the participants imagined drastically different situations where they may have been able to avoid exiting if they had not had families (Appendix F). John speculated that he might have been willing to move to undesirable locations for atmospheric science jobs if he hadn't stayed with his future-wife:

> If life was a vacuum, would I still be doing it today? I can't say for sure. My guess would be yes, because I would've moved somewhere else. If you look back on everything, it's dominoes that all fall into place. If that first one never fell, where would I have been? Would I have moved on? Would we have amicably split? What would we have done? Would I have gone out west?

Because in reality, he needed to take care of his wife and children, his exit was unavoidable: "But because all of these things happened in a row, here we are." David described a similar "vacuum" that would have allowed him to say:

> If I was still straight out of college and I didn't have a wife, I'd have stayed at that job forever. But once you find somebody and want to start settling down, you want to start a family and being off on holidays so your parents can see your

> kid… Once you start thinking it's kind of like that, it makes the walking away a little bit easier.

Three of the participants used knowledge of the current state of their former jobs to look beyond their actual exits and build certainty in them (Appendix F). Although Matthew speculated that he would have stayed if he had felt more secure or if his current job had not become available, he felt certain that he would have left his atmospheric science job eventually because the work environment had become undesirable:

> Though [chuckles] from what I understand in hindsight, with keeping in touch with some of the people, I probably would've looked to have left anyway. The nature of the organization had kind of changed to where it wasn't as fun as it had been a few years previously.

Danny easily transitioned out of atmospheric science because he "already had the credentials to do so," but he expressed certainty that he would have exited even under different circumstances: "If I hadn't been going to grad school anyway, I probably would've found a different way out of it." Similarly, Kim felt certain that changes to her schedule and tasks would have only "prolonged" her stay but ultimately would not have prevented her exit:

> So unless some radical change happened where they built the forecasting tools, shifted around schedules a little bit so I could actually have some kind of social interaction here and there… That probably would've prolonged it. But knowing where they are now, I don't think it would've fully prevented it. It would've happened eventually.

Even at the time of the interview, her former employer had not fixed their forecasting tools as promised, and this helped Kim build certainty in the unavoidability of her exit. Although Becky did not have children at the time of her exit, and she did not specifically quit her job because it made raising her children difficult, she drew from

her friends' experiences as working parents in the public sector to build certainty in the unavoidability of her exit:

> It's tough. It's tough to have a family and work shift work. It's just tough, no matter how you look at it. I see friends that are still in the public sector that have little kids and are dealing with daycare and the hoops that they have to go through to keep their jobs. I just don't think that was for me. As much as I loved the job, it's so incredibly overwhelming to have to juggle all of that. Mad props for the people that can do it, but it just… It was overwhelming to me, the amount of stuff that they have to go through. Especially when you don't have family nearby. When you're already moving to a new location and you don't have the support system there, it's hard to do. Had we had more support, maybe. Just people close by that if something happened, you could do something about it. But I don't think we could've done it otherwise. I don't think I would've wanted to do it otherwise.

b. Were their exits typical?

I asked the participants if they thought their exits from the atmospheric science occupation were typical. Of the ten participants who responded to this question, eight felt that their exits were typical (Appendix G). While the remaining two participants thought their exits were unique, they also pointed out similarities to other leavers.

Four of the participants used their knowledge of classmates, co-workers, or others that had voluntarily exited the atmospheric science occupation to argue that their exits were typical (Appendix G). Danny relayed that other graduates from his atmospheric science department also struggled with a lack of hiring:

> So I graduated with four or five friends and there were a couple in the classes behind me and ahead of me, and nobody was really finding jobs. A lot of them had gone to grad school, and the ones that hadn't were considering going to grad school since they couldn't find anything. It was just a really, really tough job market at the time.

Jacob drew upon his knowledge of his classmates' post-graduation careers to conclude that voluntary exits were "very typical":

> That's kind of the odd thing about—and I don't know if any other colleges are different—but that's kind of the odd thing about my specific graduating class. I think we graduated 12 meteorologists, and I think maybe four or five are working in the field right now that I know of. Many of us have left the field completely.

He reiterated: "Frankly, I know of more people that I graduated with that don't work in meteorology than do." Kim described a similar situation:

> I thought it was funny that I just know so many people in meteorology who have ended up going to do [laughs] different things. And I kind of was like, oh, she's doing this study! There's probably a lot of people!

David saw two of his co-workers leave in succession due to shift work:

> I think it's a little more typical than people want to say it is. From my time at my second job, we had at least— My first year there, within six months, the overnight guy left because his wife didn't want him working overnights anymore. He liked the job, but he didn't want to work overnight, so he left. Then about a year later, the guy who replaced him also left.

Four of the participants used their knowledge of the nature of work in the atmospheric science occupation to argue that their exits were typical (Appendix G). Adam attributed exits to the state of the job market at any given time: "The job market really I think is what dictates whether someone stays in or doesn't." Becky attributed exits of women from the public sector to the difficulty of balancing shift work with family responsibilities:

> Because of the shift work, I would like to say that it's probably not super uncommon for women to transition out of the public sector. It's tough. It's tough to have a family and work shift work. It's just tough, no matter how you look at it.

Kim drew upon her experience working in the private sector along with her acquaintances' experiences:

> I feel like it is typical for jobs of that nature, just because from what I've heard, at least, from the folks out in the wild trying to get jobs— And especially the two local places here, they just seem like they know that you don't have any other jobs to go to. So they came to people who are aspiring, people that just got out of college and they've got the degree that they want, and they just kind of chew them up. That's what I've really observed. And so I want it to not be common, but I feel like, at least in the private sector, it is more common than it really should be.

Four of the participants used their knowledge of the skills gained by atmospheric scientists to argue that transitioning into another occupation was possible (Appendix G). Adam noted that having other interests and skills aided transitioning into another occupation:

> I think that comes down to more what people's background is. I had the minor in computer science and already had a strong interest in it, so I was looking at jobs in that particular field. But somebody that just comes out with, let's say, a bachelor's in meteorology, I don't know where they'd go from there if they didn't get a meteorology job.

Danny relayed a story that particularly struck him about the possibility of exiting the occupation:

> I was at a conference, and the director of [organization] at the time was there. And he was talking to a couple of us off to the side, and he had mentioned that one of their student interns had gone on to become a financial broker of some sort. And we're all really kind of like, well, that's kind of a weird thing to go into with a meteorology degree! And he was like, well, it is until you stop and think about the fact that meteorology teaches you to make snap decisions using incomplete datasets, which is something that, when you study finances, you make snap decisions with incredibly complete datasets. But in the real world, you never have a complete dataset. That there's always something missing is something that's unique to meteorologists. And I had never considered that at that point, and that's the first time I had ever really considered that, well, I can get a degree in meteorology and go and do something else. I don't have to get a job in meteorology.

Becky initially partially chose an atmospheric science degree for its versatility as a "hard science" degree: "I knew that I would be setting myself up for success with a hard

science major like meteorology." She maintained that a hard science degree made transitioning to other occupations possible:

> And I truly believe you can do just about anything when you have any hard science degree. So that really helped me out. It gave me a lot of confidence to know that I could do something else.

She added:

> You really develop a keen sense of being able to do a lot of things when you have a meteorology background. You're really setting yourself up for success, even if it's not specifically weather-related.

Valerie drew upon her easy transition into a technical occupation to say that exits were possible:

> I wouldn't say it's unique. I don't know if it's typical, but I think it's not really a far reach. It's not like I went to medical school or something like that. [laughs] I was doing something that was kind of tangential to what I studied.

Danny and Jacob referenced graduation rates and job openings to argue that their exits were typical (Appendix G). Jacob briefly touched upon imbalanced supply-and-demand:

> I don't know the numbers. I haven't done the research, but— And I'm assuming you will. But it seems like maybe there are more people studying meteorology than there are jobs available.

Danny referred to exits as a "dirty little secret of the weather enterprise." He elaborated with calculations of supply-and-demand:

> I just look at the numbers. If you look at doing a rough estimation, the Weather Service has anywhere between 1,200 and 1,500 meteorologists on staff. And then if you stop and look at their hiring numbers for last year, they hired something around 50 people in from outside. And then we look at the graduation numbers for meteorology schools, and there are way more than 50 people graduating every year. And so when you take into account the fact that there's not a huge turnover in news anchor and television meteorologists— And private industry has grown, yes, but there's not 800 or 900 meteorology jobs every

> single year— And that number I'm sure is growing. I know that more and more universities are starting up meteorology programs, and that's only going to make this job market harder, because we're not making more meteorology positions. So it's good for the field, because they're going to have more of a choice. They're going to be able to find the more qualified meteorologists out there. But in terms of getting a meteorology degree, the value of that degree is going down. And so that's why I say it's a dirty little secret. Nobody wants to talk about it, but it's got to be incredibly common. The numbers don't lie.

Maggie and Courtney at first answered that their exits were not typical (Appendix G). In reference to her dislike of forecasting severe weather, Maggie explained:

> No, I don't think it's typical, because pretty much every other person in my office absolutely loves severe weather. And when it happens, they're just raring to go in the office and so excited about it. And I'm just not.

Courtney originally said that her exit was "totally just strange." However, Maggie and Courtney modified their positions to an extent while elaborating upon them, saying that they began to see how their exits might be more typical than they originally thought. Maggie drew from her experiences talking with atmospheric science students who decided to work outside of the public sector:

> And actually, I've talked to just about every single summer volunteer we've had, because they kind of make me do it, being the youngest person in the office. [laughs] But I like to talk to them. And I feel a little bit bad about this, but I tell them, keep your options open. There are a lot of other options out there. Don't just think you have to go into the public sector. The public sector is great, and it is a great job. I don't have any ill will towards the public sector at all. It is a great job. It's just not for me. And I've told the students this, and I've actually had a few of the students say to me that they're glad they had the opportunity to do that summer volunteer, because they see that it is not the career path for them. And their reasoning is the same as mine. They don't want to be in an office. They don't want to do the shift work. They want to be out doing other things. They don't know what their career path is going to be, but they know that it's probably not going to be the public sector. And so, it is a factor for some people, that drive is the same for some people. I wouldn't say everybody, but, yeah… So yeah, I guess the answer your question is, it is a factor for some people.

Courtney acknowledged that she had read recent articles about exits from academia in general, and although she did not reference atmospheric science in particular, she used these articles to evaluate her exit as a bit more typical than she originally stated:

> When I started kind of going this way, I didn't think there was anybody else who did anything like this. So now I kind of see more and more articles about how there are a lot of people that do leave academia.

c. Would they return to the atmospheric science occupation?

I asked the participants if there was anything that would motivate them to consider returning to the atmospheric science occupation. Eleven participants described situations where they might return and three participants expressed no desire to return (Appendix H). Again, their responses about the possibility of return were mixed, as each of the 11 participants who expressed the possibility of returning also described issues that would prevent them from returning.

Four of the participants described needing to find the "right job" in order to return (Appendix H). Adam wished to find a well-paying job where he could combine his interests in software development and meteorology: "Honestly, if I found another software development job that was related to meteorology and the pay was reasonable, I would do it in a heartbeat." Danny and Valerie also expressed interest in returning if they were able to find jobs where they could combine their interests in training and meteorology. In recounting his exit experience, Xavier spontaneously described the possibility of returning to a leadership position where he could make changes to the public sector:

> And I [laughs] occasionally think, if I were to at this moment stop what I'm doing now and go back to the public sector, I would totally do so, as long as it

> was in sufficient enough of a leadership role that I could actually make change their recruiting tactics, their on-boarding tactics, probably some of the personnel management, and make the whole thing much more of a modern workplace.

Three of the participants described requiring a change in location in order to return (Appendix H). Becky spoke at length about how she strongly wished to return and thought about it "every day," but her location made working in the occupation incompatible with filling her needs to be physically present with her husband and raise her children: "But again, I'm kind of in a weird location where there isn't a whole lot for me to do here, and that's always been the limiting factor." There were no atmospheric science jobs within reasonable commuting distance of Becky's current location, but she would search for jobs if she and her husband moved elsewhere: "If we moved somewhere else, I don't think I would hesitate at all to try and get a job." Similarly, Courtney wished to teach college-level atmospheric science classes, but the local college was "really awful" and "a complete disaster," and she would have to move in order to return to atmospheric science as a teacher: "If I lived somewhere with a reasonable college, I would absolutely consider going back to that." David expressed interest in returning if he could find a job that would fit his lifestyle or if he could work remotely to avoid "uprooting everything again": "But if I could find something that could allow me to do that job but remotely from my house or from even my office at my other company, I would definitely consider it."

Although several of the participants expressed desire to return to the atmospheric science occupation, they think that they are unlikely to return (Appendix H). Michael said that he would require substantial demographic changes, such as the

retirement of a large portion of the workforce, in order to make the public sector desirable enough to return:

> I would like to get back, but things would have to change. And I think it's going to have to be a big shake-up, like half the workforce retiring, to do something like that.

Matthew preferred his current work to his previous job, and said that he would only consider returning if he became unhappy with or was laid off from his current job. Although Xavier expressed interest in returning in a leadership position, he described this type of job as a "fantasy" that he took only semi-seriously:

> It would take a lot of very serious changes in the government to allow for a position like that, where one can actually come in and make drastic changes. So it may be a little bit of just kind of a… [sighs] I don't know what the right word for it is. Like a fantasy kind of job position where, if you could come in and just make everything more efficient and better, then you would allow people to actually become better at what they do, as opposed to just being so caught up in these processes and all of the hoops that you have to jump through that it's almost prohibitive as far as that goes. [laughs] So, semi-, medium-seriously.

Adam felt that his lack of supercomputing experience would prevent him from returning, even though he had moved to a location with several atmospheric science organizations. Jacob continued to apply actively for public sector jobs after his exit, but although he typically advanced to the second round of the process, he never made an interview. Given these setbacks, he felt his chances of finding another job in the occupation were unlikely, especially after being out of the occupation for an increasing amount of time. Kim "absolutely would" return "if the opportunity presented itself." However, she speculated that employers might view her increasingly long absence as a liability:

> But yeah, I would always be open to going back. But I know that it's a real hard transition to make back in because it's always changing. And once you've been

> out of the game for a while, I know sometimes folks go, well, they don't know about this new thing that happened, or they're rusty. And forecasting isn't exactly and easy or low-stress thing, and it's got a high cost if you really screw up. So I feel like it would be difficult, but I would definitely be willing to give it a shot.

Valerie expressed similar concerns about her absence from operational forecasting. She also wished to find a job where she could combine her interests in training and meteorology, but she said that she had already worked at one of the few organizations where she could blend those interests, and since she did not want to return to her former employer, she did not realistically think she would return to the occupation at all.

Although though the need for greater compensation was not directly implicated in the participants' exit decisions, four participants said that they would not return because their salaries would be lower in the atmospheric science occupation than in their new occupations (Appendix H). Adam and Valerie moved into technical occupations as a software developer and technical writer, respectively, and their new salaries were "much more lucrative" and "a stupid amount of money" compared with attainable salaries in the atmospheric science occupation. Additionally, they both enjoyed flexible schedules and heavy recruitment for other technical jobs. These benefits combined with higher pay to temper their desires to return. Adam summarized: "So my desire to get back into meteorology, while it is somewhat strong, isn't strong enough to take a major pay cut to do it, if that makes sense." Similarly, John was not open to taking a pay cut:

> No. No. The money's not there. I'm already making 20 percent more than when I left my old job. I got a raise as soon as I left my old job, and I got a 10 percent raise on top of that in my first year. I'm not going back. And that was after working at my old job for eight years.

Jacob thought that he might be able to obtain a broadcast meteorology position, given his background and interest in media, but he was not willing or able to take the associated pay cut from his already low salary:

> Could I get a small market TV job? Maybe I could. I would like to think I could. But that would probably also at this point mean a significant pay cut from an already relatively low salary. I'm not willing, and frankly, I don't think I could afford to make that choice. Even if I wanted to pursue TV, I don't know if I could afford it.

Three of the participants were uninterested in returning to the atmospheric science occupation (Appendix H). Linda was focused on her family and felt "neutral" about returning. Danny had "no desire" to return:

> I wouldn't, and that's purely because I've seen the inner workings of the public sector. I've peeled back the curtain and seen the man at the controls, and I don't like what I see, and I have no desire to be a part of it.

Maggie had no desire to return due to the lack of meaningful work, and she specified that she would only return under duress:

> I think the only thing that I could see being a factor is if it was a necessity for family needs. If down the line when I get married, if it comes up that I have to move away and that's the only way that I can get a job is to go back into meteorology, that would probably be one of the only instances that I could see myself going back. And it probably wouldn't be very willingly.

Three of the participants had opportunities to return to their former atmospheric science employers in the years since their exits (Appendix H). David's managers asked him a couple of times to come back to his company, and Matthew and Valerie's co-workers encouraged them to apply for open positions at their former organizations. These participants turned down their opportunities to return. David attempted to negotiate to change his schedule for part of the year and work the job remotely, but he turned down the offers when his managers still were unwilling to acquiesce to his

demands. Matthew and Valerie were happy and fulfilled at their current jobs and uninterested in returning to their former employers.

5. Discussion and synthesis

"One can always posit later if it is called for" (Giorgi 2009, p. 91).

"Synthesis requires an interdisciplinary or intradisciplinary effort" (LeCompte and Preissle 1993, p. 276). At present, atmospheric science does not have a strong tradition of self-investigation, especially investigation of the career development of atmospheric scientists, and there are not many data sources, tools, or studies available in the atmospheric science literature to assist with investigation of voluntary occupational exits. I interrogated what little quantitative employment data on atmospheric scientists were available as far as they allowed and presented the results in Sec. 1. Not only did these data fail to adequately quantify turnover, but they also completely failed to illuminate what voluntary exiting the occupation is like for a degree-holding atmospheric scientist and how it comes about. To better understand voluntary occupational turnover, I branched out into the literature of the social sciences. I especially drew from psychological and managerial voluntary turnover literature for background and motivation, and I structured the research design upon a qualitative research approach from humanistic psychology.

Ezzy (2002) lists "novelty"—the provision of new insights into a topic of interest—as a criterion of rigor in qualitative research. Descriptive phenomenological research approaches like the DPPM are suited to producing novel findings, since they are grounded in a philosophy that is critical of everyday understandings (Crotty 1998)

and they seek to provide revelatory, heightened insight into everyday experiences (Giorgi 2009). Phenomenological explication of the empirical interview data from atmospheric science leavers as presented in Sec. 3 has shed new light on the phenomenon of voluntarily exiting an occupation, as a leaver experiences it. To synthesize the results across both disciplines, I will now discuss the significance of the study's findings, first for voluntary occupational turnover research in general and then for the atmospheric science occupation in particular.

a. Significance for voluntary occupational turnover research

As discussed in Sec. 1, voluntary occupational turnover research has been dominated by quantitative studies that elicit brief responses to closed-ended survey measures. Turnover scholars have warned that the ability of such designs to further elucidate the voluntary occupational turnover process has stalled: The most popular turnover variables like work-related satisfaction show only weak-to-moderate relationships with turnover antecedents as well as actual voluntary turnover, and existing psychological models that attempt to trace out the steps of turnover are too complex to meaningfully explicate the process. Fresh approaches must be used if voluntary turnover research is to shake off its languor and benefit both workers and employers.

Qualitative studies of voluntary occupational turnover are a growing minority that better elucidate voluntary turnover. Through their openness to rich detail and holistic descriptions, they have moved beyond merely tracing out the steps of turnover: They have identified complex processes and interactions that make the turnover experience what it is for a leaver. As discussed in Sec. 1, these findings include: the

change of the relationship between worker and work; the importance of aligning work with values and integrating work and personal lives; the use of past- and future-oriented thinking to frame an exit decision; the importance of having a "time out" from everyday life to contemplate an exit; being guided through an exit by planless action and emotions; and making meaning and continuity from discontinuous work experiences (Krantz 1977; Osherson 1980; Cherniss 1989; Teixeira and Gomes 2000; Wise and Millward 2005; Rathbun-Grubb 2009; Murtagh et al. 2011; Witchger 2011; Way 2015; Ahn 2016). Thus, qualitative studies bring understanding of what living through voluntary occupational turnover is like by illuminating complicated, personal facets that surveys would have trouble capturing.

The current study adds to the growing number of qualitative studies that demonstrates their power to explicate the experience of voluntary occupational turnover. In particular, the current study demonstrates that a descriptive phenomenological approach like the DPPM ably accommodates the complexity of lived experience through its commitment to openness and description; eidetic analysis of empirical data; and presentation of the general structure of an experience.

Furthermore, the current study joins the small number of voluntary occupational turnover studies that have sampled actual leavers. As noted in Sec. 1, locating participants who have exited an occupation is difficult, and many studies have substituted those who intend to leave their occupations for actual leavers to circumvent this difficulty. But because so much can happen to prevent intentions from being realized, and one may act without first intending to do so, a study of the actual lived experience of voluntary occupational turnover like the current study serves as a

powerful addition to the voluntary turnover literature. The current study's research design also speaks to the usefulness of snowball sampling for locating leavers, especially when the researcher can access informants who are willing to help and are well-placed to spread the study information widely.

Finally, the current study demonstrates that the issue of ensuring that a sample does not include involuntary occupational leavers can be addressed by having participants self-identify as voluntary leavers. This is preferable to relying on the researcher's judgment (Lee et al. 1996) or on information from leavers' former employing organizations, who may classify them as different types of leavers than they would classify themselves, if they even track their former employees' occupational exits at all (Mobley et al. 1979; Campion 1991; Lee et al. 1999; Morrell et al. 2004ab, 2008; Trevor et al. 2007; Hom et al. 2012). Although the voluntary-involuntary classification may be less of a dichotomy than typically assumed (Mobley et al. 1979; Campion 1991; Hom et al. 2012), the practice of asking participants to self-identify as voluntary leavers ensures that participants subjectively view themselves as having chosen to leave, thus minimizing that source of error and gaining access to participants who can give thick descriptions of the actual exit experience.

1) THE CONUNDRUM OF SATISFACTION

The most significant finding of the current study for turnover research is that need fulfillment motivates voluntary occupational exits. This finding is novel, not because needs have been completely absent from the voluntary occupational turnover literature, but because they have been passed over in favor of focusing on more popular attitudinal variables like satisfaction.

A couple of influential early voluntary occupational turnover studies viewed need fulfillment as initiating turnover. Based on his grounded theory-inspired analysis of interviews with 25 mid-career occupation changers, Neapolitan (1980) centralized occupational dissatisfaction as the "necessary force" (p. 218) for voluntary occupation change, but he first presented "lack of congruence" (p. 217) between an individual's needs and values and the rewards provided by their occupation as causing occupational dissatisfaction. Rhodes and Doering (1983) cited Neapolitan (1980) as an inspiration for their integrated model. They similarly centralized job dissatisfaction as the driving force behind voluntary occupational turnover and presented a lack of "correspondence" between an individual's needs and desires and the rewards provided by their work environment as causing job dissatisfaction.

Despite the importance these early studies' afforded to need fulfillment, needs were not focused on in following voluntary occupational turnover studies. Quantitative tests of Rhodes and Doering's (1983) integrated model focused on job satisfaction and other attitudinal variables but struggled with correspondence: Cabral et al. (1985) and Rhodes and Doering (1993) found little support for the hypothesized relationship between needs and job satisfaction, and Blau (1989, 2007), Carless and Bernath (2007), and Carless and Arnup (2011) failed to include needs in their tests of the integrated model. Years later, Rathbun-Grubb (2009) found that a "lack of alignment" (p. 123) between a worker's needs, values, and desires and his or her work was "at the heart of job dissatisfaction" (p. 123) for her sample of former librarians, and she said this finding supported Rhodes and Doering's (1983) lack of correspondence. Beyond this,

needs were ignored in reference to the integrated model, and they largely received only passing attention in a few other quantitative voluntary occupational turnover studies.

There are a few more substantial references to needs in newer, qualitative voluntary occupational turnover studies. Wise and Millward (2005) found that, for a 30-something leaver, "the driving force for career decisions appears to be core values" (p. 412), such as the values of growing, learning, and doing work that reflects their identity. Furthermore, they found that a leaver might change occupations to find work that is more in line with their values, and "the *need* to pursue these subjective values" (p. 412, emphasis my own) is so important that they may overcome barriers to occupation change. Although the authors acknowledged the need to pursue values, they centralized "values directing the change" (p. 405) as one of three major themes, and they did not elaborate upon their finding about the need to pursue values. Later, Witchger (2011) identified the need for job security as an "internal, emotional, and psychological need" (p. 106) for "continuity of gainful employment and a confidence that the job would continue to be viable" (p. 106). He found that the need for job security affected how occupation changers interacted with unplanned events and drove them to pursue work with higher earning potential and longevity. Beyond noting this single theme, however, he did not expand upon needs. Most promisingly, Howes and Goodman-Delahunty (2014) identified "the need to be valued" (p. 67) as the overarching theme of their study of voluntary turnover from teaching and policing, with the needs to do meaningful work, have one's contribution recognized, and feel supported as sub-themes. They defined "ruptures" as events similar to shocks that specifically attack an individual's

need to be valued, and they identified ruptures as "catalysts" voluntary occupational turnover as leavers reacted to ruptures and found work in other occupations.

Voluntary occupational turnover studies such as those discussed in Sec. 1 have focused on other aspects of turnover and have not referenced needs. Although the three qualitative studies discussed in the above paragraph noted the importance of certain types of needs, they did not expand their findings into a larger, organizing structure. In contrast, the central finding of the current study is that need fulfillment provides the structure of the voluntary occupational turnover experience, at least for atmospheric science leavers. Furthermore, the current study demonstrates that unmet needs do not appear to have the causal relationship with dissatisfaction that Neapolitan (1980), Rhodes and Doering (1983), and Rathbun-Grubb (2009) hypothesized. The participants' descriptions reveal that their needs were accompanied by a variety of positive, negative, and neutral emotions, and dissatisfaction with working in the atmospheric science occupation was not implicated in all of their exits. While some participants expressed dissatisfaction with their work environments, job tasks, schedules, supervisor or co-worker interactions, recognition, opportunities for advancement, and/or job security, others expressed satisfaction with working in the atmospheric science occupation (Appendix I).

In particular, Linda, Adam, Becky, and Valerie spoke at length about thriving in and enjoying working in the atmospheric science occupation (Appendix I). Linda detailed her many "eye-opening" experiences learning about different aspects of working in the occupation as she was promoted four times at her company:

> It was showing me other sides of meteorology. That was the other great part about this company was I got to use my degree in different ways and learn about these things. That was something I really enjoyed about the company, was it expanded my horizons quite a bit. And like I said, I liked every position better within the company.

Adam spoke highly of his private sector job: "So even to this day, I'd say this was probably one of the best jobs I've had, salary aside and all." Becky repeatedly praised the close bond she shared with her co-workers:

> I loved my office. It's funny. When I first got there, it was terrifying. First time on my own. The staff was just phenomenal. It was a bunch of middle-aged white men. [laughs] But being a 22-year-old female recent college graduate, they all kind of took me under their wing. And they were just the most wonderful, kind men that I could have ever asked to help me adapt to my new situation. They were so helpful in teaching me new things and encouraging me and just helping me out with little things. Oh, I don't know where to get an apartment, blah, blah, blah. They were awesome. [sighs] You're going to be so angry at me because I'm so happy, I was so happy at my office. [laughs] They were just so wonderful. And there was a lot of turnover in the second two years that I was there. But there was something magical at that office. It was just a great mix of older and younger and we just… They were just great. [laughs] They were really good there.

Valerie appreciated her "friendly" work environment:

> It was a really good place to work. It was kind of a nice, friendly environment, which I really liked, and very laid-back. It was a nice change of pace.

She also valued having opportunities to develop her technical writing skills on the job:

> The technical writing side of me was being developed. So I just helped wherever I could, doing whatever I could. But the things I enjoyed the most were developing print materials.

Adam and Becky expressed continuing sorrow over their exits, and at the time of her exit, and Valerie would have "preferred" to have found an atmospheric science job rather than find work outside of the occupation. That these satisfied participants still left

the atmospheric science occupation, because they could not fill those needs by staying in it, illustrates that needs are separate from and broader than satisfaction.

Furthermore, a leaver who was dissatisfied with work in their former occupation may still reflect positively on their experiences (Appendix I). Matthew was unhappy with the lack of security and the slowness of the research at his organization, but he spoke highly of his time working in atmospheric science: "By and large, the vast majority of my memories whenever I look back on it are positive." Michael, Danny, and John were dissatisfied with their work environments, lack of meaningful work, and job security, and they described their time spent pursuing education and work in the occupation as "wastes." Nevertheless, they also looked back on their time in the atmospheric science occupation with some positivity. Michael described how he "absolutely loved" his job despite his complaints, and he "had fun while it lasted." Although Danny disliked his work environment and did not find his tasks meaningful, he still "very much enjoyed" them. John described a "love-hate" relationship with his job: "Looking back, I hated that job, and I loved that job at the same time, because it allowed me to have the life I have now." He added that he did not blame his co-workers or supervisors for his lack of security:

> And honestly, I have no problems with anybody at the company. It's just financials. It's numbers.

He added:

> As much as I hated it, it was ripping the band-aid off. It was one of those things where it was going to happen, and like I said, I have no ill will.

He poignantly summed up the meaning he derived from his time in the occupation by describing atmospheric science as his "first love":

> Imagine… You always have a place in your heart for your first love. And you think about your first love, there may or may not be a reason why you're still not with them. But you look at the nostalgia of it. [laughs] Like I said, you always have a place in your heart, but there's a reason you're why not together anymore.

These and other participants' retrospective accounts suggest that some of their positivity may have come from looking back on their exits after they had gained experience in other preferred occupations (Appendix I). For example, Matthew valued the useful skills he learned while working in the atmospheric science occupation that helped him transition into another occupation:

> I don't know if this is a question you'll be asking down the road or whatever, but I have to say that where I am now— I wouldn't be able to be here if it weren't for my previous job in meteorology, because it just so happened, this thing got dumped in my lap, to help out with [job task details]. So that wouldn't have come around had I not had my job in meteorology. So by no means am I bitter or anything.

Maggie was dissatisfied with her work environment, yet she also expressed that her time in the atmospheric science occupation was "necessary" for her personal growth, because she had opportunities that would have been absent in her preferred occupation:

> There's something I'd like to say about working for the public sector. Even though it's not where I feel my career is supposed to be long-term, I still feel like it was a necessary part of my career. And I say that because there were a lot of opportunities that I wouldn't have gotten if I'd spent my whole career at [outside organization]. [details about mentorship program] So I think that that was a necessary part of my career to grow personally and professionally by being with the public sector. And there's a lot of other things that I've done here that have helped me, but the key one was working with my mentor.

She added: "I don't think I would've been able to progress and be as self-confident as I am now if I had not come to the public sector."

Finally, the participants' descriptions corroborate other studies that have shown the importance of events like shocks—which, in contrast to work-related satisfaction,

are non-affective—as initiating voluntary turnover (Lee and Mitchell 1994; Lee et al. 1996, 1999; Mitchell and Lee 2001; Maertz and Campion 2004; Morrell et al. 2004ab, 2008; Holtom et al. 2005; Kammeyer-Mueller et al. 2005; Donnelly and Quirin 2006; Holt et al. 2007; Burton et al. 2010; Jones et al. 2010; Witchger 2011; Siebert et al. 2013; Howes and Goodman-Delahunty 2014; Ahn 2016). As noted in Sec. 3 and Appendix E, many of the needs that the participants described derived from unsolicited job offers, marriage, changes in a partner's employment and location, corporate mergers, disagreements with co-workers and supervisors, justice violations, and organizational changes. These events are similar to the shocks described in other turnover studies, and work-related dissatisfaction followed only in some cases.

In combination with the results of the qualitative voluntary occupational turnover studies discussed in Sec. 1, these results call for turnover researchers to move past their preoccupation with work-related satisfaction, which, despite its popularity, has in general related only weakly-to-moderately with hypothesized steps in the turnover process. These findings suggest that satisfaction is not a holistic enough variable to adequately describe motivations for voluntary occupational turnover, whereas variables related to needs and need fulfillment may have more promise. Furthermore, the participants' narratives suggest an answer to why numerous turnover studies have found little support for the hypothesized relationship between satisfaction and other steps in the turnover process: Although needs were at the heart of exits, dissatisfaction was not. Some leavers were dissatisfied with their work in atmospheric science, and others were satisfied with their work. Furthermore, even those that were

dissatisfied with their work looked back on their time in the atmospheric science occupation with some positivity.

The major finding of this study—that needs give structure to voluntary occupational turnover—suggests that needs deserve serious focus in future voluntary turnover research, apart from satisfaction and other attitudes. To meaningfully understand and address voluntary occupational turnover, it will be especially important for turnover researchers to identify where needs derive from and why they cannot be filled in a leaver's occupation.

2) THE CONUNDRUM OF EXTRINSIC REWARDS

As noted in Sec. 1, studies of voluntary occupational turnover have found mixed support for the importance of dissatisfaction with extrinsic rewards provided by employing organizations in motivating voluntary occupational turnover. Extrinsic rewards typically have been operationalized as pay and promotions, and also have included recognition, security, working conditions, opportunities for professional development, and relationships with co-workers and supervisors. In contrast, intrinsic rewards typically have included work content, meaningful work (e.g., challenging, diverse, interesting, fulfilling, valuable, autonomous, enjoyable, altruistic), and personal growth through work. Some studies have shown significant relationships between extrinsic rewards and voluntary occupational turnover (Neapolitan 1980; Rytina 1982; Herrick et al. 1983; Markey and Parks 1989; Doering and Rhodes 1989; Blau 1989; Serow and Forrest 1994; Luzius and Ard 2006; Rathbun-Grubb 2009; McGinley et al. 2014; Brown et al. 2015; Way 2015). However, even some of these studies as well as

others have found that extrinsic rewards were not as influential for leavers as other, often intrinsic rewards (Thomas 1980; Roborgh and Stacey 1987; Serow and Forrest 1994; Teixeira and Gomes 2000; Wise and Millward 2005; Murtagh et al. 2011; Ahn 2016). Several studies even have found that dissatisfaction with extrinsic rewards may be more influential for stayers than leavers (Kanchier and Unruh 1989; Cherniss 1989; Harper 1995; Whitebook and Sakai 2003; Parrado et al. 2007; Witchger 2011; Brown et al. 2015) and that some leavers earn less over time than stayers (Neapolitan 1980; Thomas 1980; Roborgh and Stacey 1987; Fisher 1988; Serow and Forrest 1994; Wise and Millward 2005; Parrado et al. 2007; Ahn 2016).

The current study found that needs related to extrinsic rewards can motivate voluntary occupational turnover. The identified needs for job security, promotion, cooperative co-worker relationships, flexible schedules, permanent work, smaller workloads, training, tools, mentorship, recognition, and financial means to take care of loved ones relate to extrinsic rewards provided by employing organizations (Appendix E). The issue of extrinsic rewards also came up in discussions of avoidability and return (Tables 3, 5). For example, David mentioned that "just" pay might motivate atmospheric scientists to "put up with" negative elements of working in the occupation, and Adam, John, Jacob expressed that they would not take pay cuts in order to return. Additionally, Matthew, Michael, Adam, Danny, John, Jacob, Kim, and Valerie noted that they gained greater salaries by transitioning to other occupations, and Adam and Valerie also gained benefits like flexible schedules and "constant" recruitment for other technical jobs.

The current study also identified needs related to intrinsic rewards, such as the needs for engaging, challenging, impactful, enjoyable or interesting work; the need for the freedom to do independent or chosen work; the need to do outdoor work; the need to do work that uses one's skills; the need to gain expertise; the need to do work that provides for closeness with loved ones; and the need to see others succeed in the occupation (Appendix E). Additionally, not all of the participants gained more extrinsic rewards by leaving the atmospheric science occupation: Linda, Maggie, and Courtney took pay cuts to transition to other occupations, and Linda lost her insurance benefits.

Furthermore, some of the identified needs blend extrinsic and intrinsic rewards (Appendix E). For example, Michael needed autonomous work, and he chafed at having to verify his research topics with co-workers and managers. Xavier needed challenging work, but his employing organization did not provide him with it. Kim needed social interaction, but her work schedule prevented her from socializing with her co-workers and friends. John wished to care for his loved ones, but his employer's instability made it difficult for him to do so. Blau (1985b) noted that extrinsic or intrinsic rewards can be only "crudely differentiated" (p. 443) from one another, and some rewards, such as recognition, advancement, and job security, have been posited as extrinsic in some studies and intrinsic in others (Wernimont 1966; O'Reilly and Caldwell 1980; Witchger 2011). The needs identified in the current study further demonstrate that there is not a hard division between intrinsic and extrinsic rewards.

These results, along with the mixed results of other turnover studies regarding extrinsic rewards, indicate that focusing on the role of extrinsic rewards may not be a fruitful avenue for quantitative turnover research to pursue, as some leavers exit to fill

extrinsic needs while others exit to fill intrinsic and other needs. Subsuming extrinsic rewards under other categories like needs may lead to stronger and more meaningful findings, or it may be better to restrict samples to specific occupations or even job types so that the importance of various rewards in a single occupation can be analyzed. Additionally, it may be useful to break samples of leavers into those concerned with extrinsic rewards and those concerned with other rewards, as mixing them will likely continue to lead to weak relationships.

3) THE CONUNDRUMS OF AVOIDABILITY AND RETURN

As noted in Sec. 1, voluntary occupational turnover is costly for both workers and employers. Several turnover researchers (Dalton et al. 1981; Abelson 1987; Campion 1991; Morrell 2004ab) have sought to differentiate avoidable from unavoidable voluntary turnover to better help managers evaluate where to make changes, although this type of research generally has "eluded scholarly attention" (Hom et al. 2012, p. 832). Campion (1991) and Morrell et al. (2004b) recommended that managers determine if the bulk of voluntary turnover at their organizations was avoidable or unavoidable: If it was avoidable, they should attempt to prevent more costly turnover by recognizing patterns and controlling the factors that are commonly associated with turnover, such as by providing internal counseling or creating a greater variety of intra-organizational jobs. However, if it was unavoidable, they should focus instead on minimizing the costs of post hoc effects of turnover, such as by streamlining new employee recruitment.

The sample for the current study was neither large nor varied enough for statistical analysis to suggest whether the majority of voluntary exits from the

atmospheric science occupation have been avoidable or unavoidable. The participants' responses do, however, reveal that avoidability may be a complex issue for leavers to discuss. Most of the participants imagined situations in which they could have filled their needs while staying in the atmospheric science occupation; however, they also expressed that such developments were unlikely to occur (Appendix F). Several participants created further certainty in the unavoidability of their exits by saying that, in retrospect, they were glad that they had left because: their former work environments had failed to improve or had deteriorated further since their exits; their work was inherently unappealing; or they had obtained better compensation in their new occupations.

The contradictory nature of the participants' evaluations about the avoidability of their exits reveals that, although questions of avoidability are of interest to researchers and managers, they are difficult for leavers to answer, since they have already lived the exit experience and can blend their actual experiences with imagined scenarios. This difficulty might mean that questions of avoidability are better asked closer to an individual's exit, rather than years afterward when they are able to draw upon substantial experiences in their newer new occupations and/or other spheres of life to construct their responses. Additionally, the participants' complex and sometimes contradictory responses highlight why the use of closed-ended questions in survey-based studies may elicit mixed, unrevealing responses, especially if the research designs do not provide for clarification via continued communication with participants.

Similarly, several turnover researchers (Luzius and Ard 2006; Rathbun-Grubb 2009; Brown et al. 2015) have been interested in finding out what circumstances would

motivate leavers to return to their former occupations. In general, the participants' responses reiterated the factors that prevented them from staying in the occupation in the first place, and drew a bit more attention to the importance of greater compensation, which the above turnover studies also found (Appendix H). This line of questioning may have been unrevealing because the participants were focused on their actual lived experiences.

4) DECISION-MAKING

Although the psychology of decision-making was not a specific focus of the current study, making the decision to exit an occupation is an integral component of the voluntary occupational turnover experience. Career decision-making in general, and voluntary turnover decision-making in particular, are areas of active study. As mentioned in Sec. 1, traditional turnover studies typically assumed that workers make career decisions rationally by systematically gathering extensive information about themselves, their current work environments, and alternative work environments; comparing that information and mentally calculating the optimal outcome; and choosing and acting upon that outcome (Phillips 1997). In an effort to guide rational career decision-making, many models have highlighted these ideal steps (Gelatt 1962; Vroom 1964; Katz 1966; Krumboltz and Hamel 1977; Pitz and Harren 1980; Gati 1986; Gati and Asher 2001). They also generally have downplayed context, uncertainty, ambiguity, unpredictability, relationships, emotion, intuition, retrospection, and personal meaning as imperfections that cause actual decision-making to deviate from the rational "ideal".

Gelatt's (1989) about-face on his earlier rational model marked a shift in theorizing about career decision-making. Especially in recent decades, other-than-

rational approaches to career decision-making have gained traction (Phillips 1997; Murtagh et al. 2011). Other-than-rational career decision-making approaches are situated in constructivism, and they highlight non-systematic, contextual, creative, emotional, relational, gendered, unplanned, unexpected, hesitant, and even unconscious aspects of actual career decision-making as it is lived by an experiencing individual (Gelatt 1989; Krumboltz 1992; Amundson 1995; Phillips 1997; Kidd 1998; Krieshok 1998; Phillips et al. 2001; Hartung and Blustein 2002; Pryor and Bright 2003; Bright et al. 2005ab; Amundson et al. 2010; Motulsky 2010; Murtagh et al. 2011). Rather than treat these aspects of decision-making as deviations from a rational ideal, other-than-rational approaches celebrate them as efficient, flexible, intelligent, internally consistent, satisfying, and wise.

Specifically, Murtagh et al. (2011) developed their Action-Affect-Cognition (AAC) model from the results of an interpretive phenomenological study of voluntary occupation change. The AAC binds strands from rational and other-than-rational career decision-making theories by centralizing the roles of both planned and "planless" actions in initiating voluntary occupation change. Leavers deliberately take planned actions, such as job search or enrollment in college courses, to change occupations. In contrast, planless actions are initially unrelated to occupational choices, but leavers later find them to have directly influenced their choices of new occupations. For example, planless action could involve taking on an enjoyable hobby that unexpectedly motivates one to switch to that occupation. The AAC additionally highlights the importance self-regulation of negative and fluctuating emotions during voluntary turnover, which occurs when leavers are led by positive emotions; build certainty in their decisions; and frame

their exit decisions in both the past and the present. The AAC also omits systematic search for and evaluation of alternative occupations, which is a hallmark of rational models and studies.

The AAC has not yet been tested, and while the current study cannot serve as a formal test of the AAC, the findings support its veracity and expand upon several of its components. First, many of the participants engaged in planless action that became significant in their exits. For example, Matthew attended a conference at his employing atmospheric science organization's request and networked years before his exit, without intending to leverage his connection to gain outside employment. Jacob kept his part-time weekend work at a local radio station as an enjoyable hobby, not intending to make it his full-time job. Kim maintained her friendship with a college classmate without intending to apply to his company. Michael initially pursued a graduate degree in another technical field to help him find atmospheric science employment, and he did not expect to use his degree to move into another occupation. Murtagh et al. (2011) also noted that happenstance and chance can drive planless action. Linda, Michael, Courtney, and David received unanticipated job offers, while Danny and John moved into roles that opened up unexpectedly. Danny did not at first frame his decision to move into a systems administration position as a decision to leave the atmospheric science occupation, which illustrates the planless nature of his actions:

> I think the biggest takeaway I have from the entire experience, looking back at it, is that originally, I hadn't considered it as though I was leaving the meteorology field, as though it was this big final decision, until it had already happened. I had actually stopped and looked at it and said, no, I've migrated away from this. I didn't sit down one day and say, no, I'm not going to be a meteorologist anymore. It kind of happened organically over time.

John did not have any interest in accounting before his father-in-law's death, but he used his needs to point him in that direction without deliberating over other options (Appendix E):

> I knew nothing, literally nothing, of accounting when I started. I only tried it because it was something out there that was a need.

Other participants engaged in planned action to exit through job search. Matthew eventually leveraged his technical experience and professional connection to gain employment in a related occupation to find greater job security. Although he had enjoyed his work and did not wish to leave atmospheric science, Adam actively searched for and applied to computing jobs in order to make money while following his girlfriend, while Danny partly chose to attend graduate school in a related field to help him find outside employment near his girlfriend. Maggie wished to escape the atmospheric science occupation, and she actively searched for jobs to return to her preferred previous occupation. Valerie was intrigued by the thought of working in another occupation, and she deliberately searched for outside jobs. In other cases, initially planless action turned into planned action over time. Michael initially pursued a graduate degree to diversify his skill set and better qualify for forecasting jobs; his enjoyment of what he learned, as well as the favorable job market in that other occupation, led him to decide to take his unexpected job offer and exit atmospheric science. John actively searched for accounting jobs when his needs to take care of his family and maintain job security became urgent.

Murtagh et al. (2011) noted that all of their participants "tried out" their new occupations through hobbies and "described finding that they were skilled and capable

in the new field and drew on the positive emotions related to the new career" (p. 255) to guide their exit decisions without systematically searching for and evaluating multiple alternative occupations. As such, the AAC includes strong positive emotions associated with a new occupation as guiding leavers to new occupations. Matthew, Michael, Adam, Danny, Maggie, Xavier, Courtney, Jacob, and Valerie seem to exemplify this aspect of the AAC. Matthew and Michael drew upon their enjoyment of technical work to build certainty in their decisions to transition into other occupations. Michael in particular said that he "felt in his element" while taking graduate courses in another technical field:

> Oh, it was phenomenal. It was a lot easier than I thought it would be. Everyone talks about grad school being like a nightmare, but I just felt in my element.

Adam had enjoyed using computers since childhood. He pursued a minor in computer science in college and computing-heavy work in the atmospheric science occupation, and his enjoyment and experience led him to search for software development jobs when transitioning out of the atmospheric science occupation. Similarly, Danny had enjoyed computing since childhood, and he pursued of a graduate degree and job in IT partly because of this interest. Valerie was excited to try working in a different occupation, especially since she was able to put her technical writing skills into use at a highly respected company, and she felt "neutral" about leaving the atmospheric science occupation. Furthermore, Linda's experience illustrates that positive emotions do not necessarily have to be related to new occupational work to motivate change. Family was a "big part" of her transition, and she described how her excitement to move to closer to

her parents trumped negative emotions related to leaving the atmospheric science occupation:

> I was pretty neutral. The excitement was more moving to home. I was indifferent on the job that I got as long as I enjoyed it.

She reiterated:

> But no, I didn't really have any negative or positive emotions either way. It was pretty neutral. I was just really happy to be moving close to home.

Many of the participants constructed certainty in their exit decisions by framing them as "right" or necessary. For example, Matthew described his exit as a "mixed blessing" that occurred at "the right time" because he had been becoming frustrated with the slowness of research at his organization, and he was still early enough in his career to change occupations without disrupting his finances or family life. Danny also framed his decision as occurring at the "right time." Of pursing a graduate degree in IT, he said (Appendix E):

> And it was a two-pronged thought process that I had gone through. I had been considering it for a while, simply because I knew I needed to diversify my skill set. Being just a meteorologist wasn't good enough, and that had become apparent by not getting anything back from any of my job applications. The other half of that is, my girlfriend got her degree in [discipline], and there's a limited number of jobs geographically that she could excel at. Her career options are tied to specific places. And the thought process was, the chances of her getting a job in her field, and me getting a job in my field, that were in the same place was so incredibly low, it wasn't going to happen. And so having a passion for IT anyway, it just seemed like the right time to go ahead and bite the bullet and start going down that path.

He also framed his decision as something he "had to do" in order to support himself and his future family (Appendix E):

> It's great to have a passion, and I've always believed in the idea that if you love what you do, you'll never work a day in your life, which is exactly what I try to

> do. But again, at the end of the day, you've got to support yourself and your family. And if you can't do that with your passion, you have to move on.

Similarly, John felt that he "had to" exit in order to care for himself and his family (Appendix E):

> I didn't leave because I wanted to. I left because I had to. I left because they were going to kill me off anyway. But I didn't leave weather because I wanted to. I left weather because it was the right thing to do.

The AAC holds that building certainty reinforces a decision by regulating negative and/or fluctuating emotions. However, several of the participants' narratives reveal that building certainty in an exit decision does not guarantee that the decider will avoid unpleasant or fluctuating emotions. Becky, Courtney, and David built certainty in their exit decisions by appealing to the benefits of leaving and their positive emotions related to being with family, but each still expressed emotional pain over their decisions. For example, Becky saw her goals as shifting from work to family (Appendix E):

> I think it was more of, I had new goals. We were finally going to be living together. I started seeing more of the family goals. It wasn't so much about what I could do with my job. It was more about what we could do as a family. It's hard to be a female and do everything. So I think I went more towards the familial part of it than I did towards the job part of it.

Nevertheless, she expressed anguish in making her "awful" decision. She put off her decision for two years to deliberate and search for ways to stay in the atmospheric science occupation, and she actively wished to return to the occupation years after her exit, at the time of her interview. Courtney also described her exit decision as "excruciating" despite filling her need to stay near her husband. David felt "ok with

walking away" to gain the family life he desired, but he still questioned his decision years later:

> I would say it wasn't an easy transition. [job details] And I'm just going to walk away from that to go do I don't know what? [laughs] That was a very scary time. It was very hard for me to do. And there are times I have a bad day at work now and I'm just thinking, you were doing what? And you just walked away from it?

These accounts suggest that building certainty may not always completely enable leavers to regulate their emotions.

The AAC also includes temporal framing and perceiving continuity as part of self-regulation. A voluntary occupational exit could be seen as a discontinuity in one's career, but according to the AAC, leavers may attempt to frame their exits as a continuation of past work. All of the participants in the current study noted that the experience and skills they gained while working in the atmospheric science occupation helped them successfully pursue employment in their new occupations. For example, Matthew felt that he "wouldn't be able to be here" if he had not gained technical skills while working at his atmospheric science organization that smoothed his transition (Appendix I). Linda, Michael, Becky, Xavier, Courtney, and Valerie used their customer service, information systems, critical thinking, computing, teaching, and technical writing skills that they learned while working in the atmospheric science occupation to help them transition successfully to new occupations. Adam particularly noted that his "unique background" in atmospheric science helped him get recruited for technical jobs and transition out of the atmospheric science occupation:

> So I don't know that this is the case in meteorology, but at least in the software industry, technical recruiters are both highly annoying and very useful at the same time. [laughs] I probably get recruiter emails sometimes daily, sometimes

> weekly. It's a little crazy. [laughs] Especially having sort of a unique background, I tend to get that maybe more often than some others as well.

Although the above examples of continuity are positive, Adam also illustrated that historical aspects of a leaver's career can negatively impact their exits. He connected his insufficient skill set and resulting inability to apply for interesting atmospheric science jobs to his undergraduate and graduate research projects (Appendix E):

> The jobs that I was seeing tended to involve clustered systems. This is again one of those things where early experiences shape what happens down the road. Because I worked with [research topic description], I never had the opportunity to use the supercomputer and get experience doing things like MPI development for multi-processor environments and whatnot. And so now, even if I wanted to jump into a job at [local research organization], a lot of them require MPI experience and various other things, and you can't really gain experience in those things on your own. You need to have access to a supercomputer or something along those lines. So, there are things earlier on that sort of made it difficult to try to get back into meteorology as well.

"One's decisions today are an expression of one's beliefs about tomorrow" (Gelatt 1989, p. 255). According to the AAC, occupational leavers also may draw upon anticipation of the future in deciding to exit. For example, Michael decided to take his job offer to ensure his security while "keeping his ear to the ground" for a potential return to the atmospheric science occupation. Danny considered his ability to provide for his future family alongside the insecurity and low compensation of contract work in the public sector. Becky anticipated having a "normal" marriage with her husband, and David considered if he would be able to raise children with his schedule. The participants' decisions reflected what they believed about their futures: They would not be able to fill their needs while remaining in the atmospheric science occupation.

The above findings suggest that the AAC holds much promise for illuminating voluntary occupational turnover decision-making, and it should be tested in full. This is

especially important because new frameworks besides Rhodes and Doering's (1983) integrated model are much needed to freshen voluntary turnover research.

5) THE RELATIONSHIP BETWEEN VOLUNTARY EMPLOYEE AND OCCUPATIONAL TURNOVER

As discussed in Sec. 1, much voluntary occupational turnover research has derived from voluntary employee turnover research, including the only comprehensive model of voluntary occupational turnover. Nevertheless, the two experiences often treated as similar but separate, and occupational exits sometimes are seen as a more extreme type of coping mechanism than job quits (Blau 1985a, 1988, 1989, 1998; 2000, 2007; Elsass and Ralston 1989; Aryee and Tan 1992; Blau et al. 1993, 2003; Meyer et al. 1993; Carson and Bedeian 1994; Krausz et al. 1995; Carson et al. 1995, 1996; Carson and Carson 1997; Lee et al. 2000; Hackett et al. 2001; Hall et al. 2005; Chang et al. 2007). The findings of the current study draw attention to the close interplay of occupational and employee turnover, in that the need to escape a single undesirable job can prompt an occupational exit if no other jobs are readily available. Similarly, Rathbun-Grubb (2009) found that 90% her sample of library science leavers were satisfied with the library science occupation even though they were dissatisfied with their jobs, and they exited the library science occupation in quitting their jobs. Way (2015) also found that 60% of her sample of information technologists reflected positively on the occupation, yet still exited it in quitting their jobs, and many of the above quantitative studies have noted overlap between corresponding organizational and occupational variables. Future turnover research must address if it is useful to

continue separating voluntary employee and occupational turnover, or if it arbitrarily inhibits understanding voluntary turnover of either type.

b. Significance for the atmospheric science occupation

1) QUALITATIVE RESEARCH IN ATMOSPHERIC SCIENCE

Qualitative studies are a growing minority in atmospheric science. Especially in the last decade, atmospheric scientists have become interested in social science, which has a much stronger tradition of qualitative inquiry. Interest has particularly flowed from the realms of climate and hazardous weather research, since their effects on society calls for greater collaboration and communication with scientists in other disciplines as well as policy makers, stakeholders, and the general public. Several actions particularly demonstrate the growth of social science and its research practices in atmospheric science. First, NCAR established Weather and Society Integrated Studies (WAS*IS) in 2005 through its Societal Impacts Program (SIP). Demuth et al. (2007) noted that formal paths for meteorologists to learn about social science were lacking, and WAS*IS originally was established to introduce atmospheric scientists to social science approaches. WAS*IS rapidly grew into a vision to "change the weather enterprise by comprehensively and sustainably integrating social science into meteorological research and practice" (Demuth et al. 2007, p. 1730). To accomplish this, WAS*IS provided workshops to bring together atmospheric and social scientists to learn about perspectives, ideas, and methods—including qualitative methods—from both disciplines. Interest in WAS*IS was greater than its founders expected, and extra workshops were scheduled. Although the last workshop was held in 2011, the WAS*IS community continues to grow new followers through social media and conference

events. Second, the AMS established the *Weather, Climate, and Society* journal to create a scholarly forum for social and climate scientists whose research "can no longer be examined within a single discipline or even field of science" (Balstad 2009, p. 5). This journal was an illustration of how the AMS "recognized that this work is even more valuable when it encompasses the social as well as the meteorological sciences" (Karl 2009, p. 7). Third, the AMS (2014) additionally called for "stronger integration of the social sciences in the design and execution of future weather and climate research as well as the dissemination of atmospheric information" (p. 1) in their statement on Strengthening Social Sciences in the Weather–Climate Enterprise. This statement drew attention to qualitative methods such as interviews, focus groups, ethnography, and participant observation and noted that they are "appropriate for exploratory, highly complex, emotive, or sensitive topics about which little is known" (AMS 2014, p. 1). The AMS also noted in their statement that the work of social scientists could drive advances in atmospheric science.

Although the current qualitative study focused on an aspect of the careers of degree-holding atmospheric scientists rather than climate or hazardous weather, I argue that the extensive description of its qualitative research design found in Sec. 2 supports qualitative research in other realms of atmospheric science. In particular, I have laid out the perspective and steps of the DPPM (Giorgi 2009) in great detail to promote it to other atmospheric scientists. I was able to locate only one other study in the atmospheric science literature in which the authors referenced a phenomenological methodology (Sivle et al. 2014), but their write-up revealed that their research design was not actually phenomenological, in that key phenomenological concepts like the

epochè or bracketing, reduction, and general structure were not mentioned at all, and analysis proceeded inductively.[8] Descriptive phenomenological approaches like the DPPM are appropriate for exploratory study and to "refresh" stagnated lines of research, and I hope that this study inspires other atmospheric scientists who wish to study social issues to consider using a phenomenological approach.

2) CONTEXT

Thomas (1980) and Cherniss (1989) recommended that turnover researchers sample voluntary leavers from single occupations in order to gain insight into the crucial roles played by specific contexts in occupational exits. Carless and Arnup (2011) noted that the influence of context on voluntary occupational turnover has been understudied relative to the influence of personal characteristics such as age, educational background, and personality, even though many voluntary occupational turnover studies have noted the importance of various contexts. They recommended that qualitative studies be leveraged to investigate context. I will add that attention to context is vital for a qualitative study to be transferable to other contexts.

Phenomenological research approaches are suited to determining influential contexts. Merleau-Ponty (1962) pointed out that philosophical phenomenology, in focusing on transcending the natural attitude, "tries to understand the natural attitude better than the natural attitude can understand itself" (p. 26). Similarly, in leveraging the DPPM to search for the general structure of an experience of interest and answering "how" that experience comes about, illuminates the vital importance of context in

[8] Although Quardokus et al. (2012) cited phenomenology as their theoretical perspective, they used a grounded theory-inspired methodology.

enabling experiences to happen: Without context, an experience could not be lived by an individual at all!

The current study gives insight into the roles contexts play in both driving atmospheric science leavers' needs and inhibiting their abilities to fill their needs. The structure of the experience of voluntarily exiting the atmospheric science occupation—that of leaving to fill needs—is realized only when an individual interacts with determining occupational contexts. Additionally, the themes and relevant meaning units that support the general structure are steeped in context specific to the atmospheric science occupation, such as the geographic clustering of jobs, the increase of computing requirements, and the prevalence of shift work (Appendix E). I highlight here three contextual themes that determined many of the participants' exits: Framing exits in a larger context containing other degree-holding atmospheric scientists; the role of the Great Recession in affecting the nature of working in the atmospheric science occupation and the availability of atmospheric science jobs; and changes in the private sector. A fourth theme—the prevalence of issues related to supply-and-demand—is discussed in the following sub-section. These contexts are detailed, not only so that readers can gain a more nuanced understanding of how the exit experience can come about, but also so that readers can evaluate how the research findings would transfer and apply to atmospheric scientists in the future, or to voluntary leavers from other occupations.

Many of the participants framed their exits in a larger context that contained other atmospheric scientists. In Sec. 3 and Appendix G, results were presented for the

participants' responses to the question: Was your exit typical? In their replies, Adam, Danny, Maggie, Becky, Jacob, and Kim connected the occupational factors that impacted their exits to other atmospheric scientists, some of whom they knew had already exited the occupation. Beyond just answering this question, many of the participants spontaneously framed their exit experiences in a larger context that connected them to other atmospheric scientists. In particular, they noted that the same factors that prevented them from filling their needs while staying in the occupation affected other atmospheric scientists. For example, Xavier saw his co-workers acting as if they experienced the same lack of meaningful work that impacted him (Appendix E). He said:

> And I think that's probably the biggest, high-touch, first-impact that I was very, very negatively affected by. It was that not only did I get the feeling that there wasn't a ton of work to go around, but looking around, I would see a lot of other people, actual career meteorologists, acting as if they felt very similarly.

He initially attributed the lack of work to the time of year and location of his first office, which were conducive to calm weather. However, after gaining employment at another office in a much different location, he realized that the issues he saw permeated his over-arching employing organization:

> I don't think it was indicative of any one particular office or any one particular person, because the same thing happened, too, on a much smaller scale, at the office in [first city]. And I think I had… So previously I had mentioned that I had found that I had a lot of free time, and I had attributed it to kind of the lack of actual forecasting that needed to happen. I got to [second city] and determined that that was actually not the case. And it was just kind of the way that the public sector has its personnel management structured.

At the end of our interview, when I asked if he wanted to add any more details, Xavier reiterated that the occupational factors that prevented him from filling his needs also affected other working atmospheric scientists:

> I just really want to reiterate— And I don't know if I kind of impressed this enough upon you while we were talking about it. The way that the public sector structures its shift work and its scheduling and its over-formality of everything is so detrimental to employee happiness. And this is not just me speaking. This is me speaking after conversing with lots and lots of people who feel very similarly, who are still employed in the public sector.

He noted that he had talked with about 20 to 30 people in the public sector about similar issues: "Pretty much everybody that I worked with in some capacity feels that." He also spoke with a friend who worked in the private sector about his similar complaints. Similarly, Michael and Danny discussed issues with other atmospheric scientists working in the public sector who felt the same way about their undesirable work environments. Danny summarized: "I've talked to a lot of people inside and outside the public sector, and they all agree that they've done this to themselves."

All of the participants graduated with atmospheric science degrees, searched for jobs, obtained jobs, and/or exited the atmospheric science occupation during the Great Recession and its aftermath. Several of the participants noted that related economic contraction and instability affected their exits as well as the job search activities of other degree-holding atmospheric scientists (Appendix E). Although Michael obtained a contracted job with the public sector, he became "disheartened" by seeing the difficulties other degree-holding atmospheric scientists were having finding jobs due to few openings and high competition:

> When I was working full-time after having all that experience in the public sector and seeing it wasn't just me— Everyone I graduated with had the same

> issues I had. They had gotten internships at TV stations and everything and whatnot. And then with the economic downturn, there were just so many of us with meteorology degrees that could just not find work, period. And so that was disheartening. And then, I feel like it's been compounded because this year I was a kind of capstone mentor for some local university seniors. And I've met up with quite a few of them and I've been trying to keep tabs on them, Facebook and everything. And it seems like that's just how everyone is right now. Everyone graduated with this degree that's really hard to get and then it's just like, you get this one opening and get 500 applying for it. And so that was what really started turning the gears, where I'm like, ok, maybe I thought I had it figured out, and that was a big test. Maybe I was completely wrong.

He added: "It was the fact that so many people who were really smart and really talented and really qualified could not find jobs, period." Seeing this pervasive difficulty partially drove his motivation to accept his unexpected job offer in another occupation. John began full-time work in the private sector as the Great Recession started:

> Keep in mind, this was right when things are about to go to crap in the economy. The recession starts not too long after. Actually, the recession started right on my honeymoon.

He stayed with his disliked job for several years to maintain stability during the Great Recession, and he served as the breadwinner while his wife was temporarily unemployed. He continued to hold onto his job to provide additional security after she regained employment:

> So I'm still doing the same job, still doing the same job. So the economy's really taking a dump at this point, and I was just like, you know what, I'm just going to keep doing this because it's stable. My wife ended up losing her job in 2009. So I was like, I got this job, I'm doing it. I carry the insurance. Basically, I was breadwinner without being the full income. I was all the fringe benefits. My wife did get a job again. I think it took her two months to find something. But throughout this whole situation with the economy being the way it was, I was just like, I'm just going to keep doing this.

He added:

> I hate that job. I'm doing it because I have to. I'm doing it because it puts food on my table. It feeds my child.

David described how the Great Recession indirectly affected his exit. His wife, who also worked for his private sector company when they met, was laid off near the beginning of the Great Recession, and she moved to an adjacent state to find employment in another occupation. This led to scheduling conflict, since her traditional work schedule no longer matched his non-traditional schedule.

In particular, participants noted that hiring and the nature of working in the public sector were affected by the 2013 United States budget sequestration and the following National Atmospheric and Oceanic Administration (NOAA) hiring freeze and ban on non-mandatory training, which began on March 27, 2013 (Sullivan 2013) and was lifted on January 31, 2014 (Uccellini 2014). The hiring freeze directly affected participants who were working in the public sector (Appendix E). For example, Matthew attributed his organization's budget cut, which lessened his sense of security and eventually led to his exit, to the Great Recession:

> The whole reason our funding was going to be cut in 2013 was the effects of the Great Recession were finally starting to be felt in government. Sort of the trickle-down effect.

Michael described becoming disheartened with seeing how "the sequester had really taken its toll on morale," "butchered" training—funding for which had already been in decline (Downey et al. 2013)—and prevented qualified from graduates from obtaining public sector jobs. He summarized: "So that was disheartening for someone like me who saw that the embers for people who really wanted to change and really wanted to push stuff through were just kind of squashed out by the sequester." Additionally,

Michael had wished to work in the public sector since childhood. He interned at a public sector office during college but graduated during a NOAA hiring freeze. Because he was initially unable to find an atmospheric science job, he attended graduate school to diversify his skill set and wait out the freeze, and he eventually exited the occupation to take work related to his graduate degree. Similarly, the NOAA hiring freeze shaped Danny's initial job choice and eventual exit. Danny also had wanted to work in the public sector since childhood, but he graduated "right in the middle of that hiring freeze." Although he sent three to four applications a week for "any forecasting position he could find" in his area to avoid moving far away from his family and girlfriend, he received no offers. Several months after graduation, he leveraged a connection and obtained a job as a public sector contractor. After spending so much time searching unsuccessfully for jobs, he took the job out of necessity, but it did not fill his need for meaningful forecasting work:

> But it wasn't really what I wanted, because it wasn't forecasting. It was physical science, it was instrumentation and electrical engineering, that type of thing, but it wasn't forecasting. So I don't think I was ever truly 100 percent happy with doing that. I mean, I very much enjoyed it, but it wasn't exactly what I wanted to be doing. It wasn't the forecasting, it wasn't using what I had learned for three-and-a-half years of school.

He eventually escaped his work environment and pursued more meaningful work by exiting the occupation to take work in an occupation related to his graduate degree. Xavier attributed some of his complaints about his undesirable public sector work environment to budget concerns and the consequent inability to replace out-dated tools:

> And a lot of time people just sat around and just complained about stuff, primarily because their tools were inadequate and the software and hardware that they were using is very antiquated. And all this is because it's impossible to get funding. This is also right when the hiring freeze was instituted. There were

> a lot of budget concerns. So, it may have also been a little bit of a transitional period in the public sector itself, which may have led to some of these conditions.

Becky attributed her inability to find a public sector job in a bigger city where her husband could also find work to the hiring freeze:

> I always thought, well, maybe I'm going to get a job in a big city. You have your M.B.A., we can be in a big city together. And it just never panned out. And that's one of the hardest things with the public sector jobs. They're open and then they're not. And then there's a hiring freeze and then there's not. And there's just no way to have any stability.

Because she was not able to obtain a public sector job in a bigger city, she eventually exited the occupation to move to her husband. The NOAA hiring freeze also affected participants who did not work with the public sector but wished to. Kim searched unsuccessfully for public sector jobs during the hiring freeze while trying to escape her undesirable private sector work environment:

> Again, I was really hoping that the Weather Service would open up. But that was when the government kept getting shut down. They weren't hiring. Everything was on a freeze.

Federal funding given to universities for atmospheric science research experienced a large dip during the Great Recession and generally rebounded thereafter (Fig. 4). Despite the overall rise in funding, Courtney attributed her and her classmates' difficulties finding post-doctoral or other research-oriented positions after graduation on reduced funding in the academic sector:

> And again, during especially that specific year, there were just no positions. The funding situation was so horrible. There were no post-docs to be had. And those that were…I applied to several and never heard anything back. And there were two other people in my research group that defended within a couple months of me, and we were all in the same boat.

These difficulties fed into her exit by giving her distaste for academic work (Appendix E):

> And so that and the whole funding thing was just— Because right at the time I graduated it was just like, there's no funding for anybody to do anything. And both of those experiences were just kind of a real turn-off. I mean, the funding thing definitely played a role. I was concerned about the future of research positions.

During the time that the participants graduated, searched for jobs, obtained jobs, and/or exited the atmospheric science occupation, several corporate mergers occurred in the private sector, such as Weather Service International's purchase of Weather Underground (Schwartz and Stelter 2012). Several of the participants noted that changes in the private sector impacted their exits (Appendix E). For example, David mentioned that corporate buy-outs diminished public sector job availability:

> And especially, too, it seems like the private sector, those acquisitions by bigger hands and stuff, it's getting smaller, and there's not always those opportunities. You yourself heard about the dissolving of [company], and I think [other company] was just before that. There's not as many of those spots to go around as there used to be.

Michael echoed:

> The opportunities that used to be there are not there, and you have a lot of people who have a lot of experience who have been let go at companies. It's not as easy as it used to be.

John was directly affected by corporate buyouts, as larger companies purchased his company twice during his tenure, and many of his co-workers consequently were laid off:

> So one of the corporate buyouts, they start cutting people. So my department loses four people, and that's including one of the higher mid-level manager positions that was in my department.

Two more co-workers in his department were cut as part of the second merger, and these events increased John's sense of insecurity:

> Now on the job side of things, the company changed hands. In the next three years, it changes hands two times. Corporate takeovers. So in my mind, I'm waiting for the ax to drop at any point.

Additionally, John's schedule shifted to an undesirable early morning slot to fill in a gap that the job cuts had produced, and this enhanced his need to escape an undesirable work environment:

> I have to get my hours shifted to 3 a.m. to noon. With a newborn, with 10 credits, with 40 hours a week. [laughs] [schedule details] There was a need and I filled it. [laughs] The guy who I replaced, he had weekends off. I didn't get weekends off. My weekend off was like Tuesday–Wednesday. Like I had just the crappiest crap you could ever crap. [laughs] So things just started deteriorating on a slow downward trend at this job. It took years.

FIG. 4: Annual federal funding given to universities for atmospheric science research, compiled from data published from the NSF's Survey of Federal Funds for Research and Development. Dollar amounts (vertical axis) are given in million USD.

John also noted that the decline of print media diminished his job security in the private sector. He worked in his company's media department and feared for his security as demand for print media decreased:

> Newspaper business: Every time we turn around, our revenues… As much as I could gather, they just dwindled, dwindled, dwindled.

Shrinking revenues along with corporate buyouts and lay-offs added to John's fears for his security.

Finally, the participants noted several other important contexts that are not commonly mentioned in studies of turnover that use samples from other single occupations or mixed samples of leavers. One was the challenge of finding work in a small field, which is captured by the theme "overall lack of jobs" (Appendix E). Other turnover studies that have restricted their samples to single occupations have focused on business, banking, medical, human service, management, transportation, and educational occupations, which have many tens or even hundreds of thousands of total jobs (Herrick et al. 1983; Blau 1989; Cherniss 1989; Kanchier and Unruh 1989; Serow and Forrest 1994; Higgins 2001; Whitebook and Sakai 2003; Luzius and Ard 2006; Blau 2007; Rathbun-Grubb 2009; Hwang et al. 2011; de Croon et al. 2014; McGinley et al. 2014; Brown et al. 2015). In contrast, the atmospheric science occupation had only about 11,800 total jobs as of 2014 (BLS 2015). Combined with hundreds of new graduates each year, a small number of jobs can drive up competition and inhibit finding employment in the occupation. Another important context was the clustering of atmospheric science jobs in certain cities. Atmospheric science jobs are clustered in the Boulder, CO, Washington, D.C., Boston, MA, New York City, NY, and Houston, TX

metropolitan areas, with smaller clusters in Minneapolis, MN, Albuquerque, NM, Portland, OR, Norman, OK, and other large and moderately sized cities (BLS 2015). Such cities were not available to some of the participants, either due to a difficult commute or their distaste for moving to those cities; these instances are captured in the theme "lack of geographically-available jobs" (Appendix E). I could not locate other occupational turnover studies in which geographic clustering specifically was mentioned, although Carless and Arnup (2011) noted that Lewis and Thomas's (1987) study of leavers who held degrees in science, technology, or engineering "suggested" difficulties related to geographic location. Finally, several of the participants mentioned the context of shift work and long hours as preventing them from filling their needs; these instances are captured in the themes of "need to escape an undesirable work environment," "need for social interaction," and "lack of fit with life demands" (Appendix E). Although these issues have been brought up in samples of social workers, librarians, information technologists, and managers (Herrick et al. 1983; Luzius and Ard 2006; Rathbun-Grubb 2009; McGinley et al. 2014; Way 2015; Brown et al. 2015), shift work is still fairly unique to the atmospheric science occupation, at least for weather forecasters, and is an important context to consider.

3) SUPPLY-AND-DEMAND

Mass (1996) and Knox (2008) called for more honesty about employment in the atmospheric science occupation. Having honest, consistent, and detailed data about the nature of working in the occupation is important to current and aspiring atmospheric scientists, so that they can evaluate their career options and decide how to best pursue their goals. Having such data is also necessary for leaders in the field to monitor the

health of the occupation, address concerning developments, and modify educational programs to address employment trends. Specifically, Mass (1996) and Knox (2008) wished for more employment data in order to address the problem of imbalanced supply-and-demand, where the balance was skewed much more toward the supply of new atmospheric science graduates than the demand for employees. They warned that the resulting imbalance would hinder new graduates from obtaining atmospheric science jobs, due to an undersupply of entry-level jobs, stiff competition, and low entry-level salaries compared to other scientific, mathematical, and technical fields.

Mass (1996) issued his warning about "a deterioration in job availability" (p. 1262) when the National Weather Service (NWS) completed its modernization program and ended associated new hires; a 1995 NOAA hiring freeze went into effect; and both research and operational funding tightened due to domestic budget constraints. Over a decade later, Knox (2008) noted that the expansion of weather-related topics into popular media had increased interest in atmospheric science, and growth of degree conferrals from both expanding atmospheric science programs and new programs fed the supply of new graduates more rapidly than demand grew. As discussed in the previous sub-section, several of the contexts that affected the participants in the current study were similar: During the Great Recession, budgetary constraints and a government sequester drove a NOAA hiring freeze. At the same time, annual atmospheric science bachelor's degree conferrals leveled out at an all-time high. In Sec. 1, I reproduced Knox's (2008) analysis and extended it into the 2010s (Figs. 1, 2, 3). My analysis revealed that, while the yearly supply of new graduates reached 745 bachelor's degree conferrals in 2006–2007 and leveled off near that high thereafter,

imbalanced supply-and-demand extends even into the present, with a new high of 751 bachelor's degree conferrals in the 2013-2014 school year.

Knox (2008) warned of the potential for a boom-bust: Unsustainable growth of degree programs and chronic oversupply of new graduates could create a lack of jobs, high competition, and low pay that might eventually lead to a bust in new majors as aspiring atmospheric scientists questioned: "Why major in meteorology instead of something else, if I'm less and less likely to pursue a career in meteorology with this degree" (p. 881)? Although a boom comes from a period of oversupply, busts can lead to imbalanced supply-and-demand where there are not enough qualified graduates to fill employers' demands for workers. Knox (2008) drew upon the geosciences as a stark example of a boom-bust. According to the NCES, the geological sciences (geology, geochemistry, geophysics, seismology, and related geological sciences) experienced rapid growth from the mid-1960s through the 1980s and reached a peak of 6,549 bachelor's degree conferrals in the 1983-84 academic year (Fig. 5). This peak was coincident with the "oil boom" of the 1980s (Keane 2005). A precipitous drop in both petroleum and mining markets and geoscience enrollments followed, and geoscience conferrals plunged to a low of 1,784 bachelor's degree recipients in the 1990-91 academic year. Graduation rates grew slightly and stabilized to around 3,000 annual bachelor's degree conferrals from the mid-1990s through the 2000s.

Although the supply of geoscience bachelor's degree recipients has been growing steadily throughout the last decade, the geosciences continue to suffer from their bust, and they will do so for the foreseeable future. The AGI's 2011 Status of the Geoscience Workforce report warned that the bust in geoscience graduates decreased

the relevance of and investment in the geosciences: “Given the demonstrable shortage of geoscience talent in the U.S. economy over the last decade, the geoscience profession has experienced substantial erosion in regards to public awareness of the profession as well as investment in geoscience education” (Gonzales and Keane 2011, p. 95). Based on expected growth combined with an aging workforce, Gonzales and Keane (2011) projected that the supply of new geoscience graduates would not catch up with demand for decades, and that by 2030, the unmet demand for geoscientists in the petroleum industry alone would be about 13,000 workers. Wilson (2014bc) predicted that overall unmet demand for geoscientists would reach 135,000 by 2022! Furthermore, a sizable percentage of geoscience graduates work outside of the occupation, thereby enhancing this shortage. According to the AGI’s 2013 Geoscience Student Exit Survey of 71 geoscience departments, about 20% of bachelor’s degree recipients and 8% of graduate degree recipients had found or were seeking jobs outside of the geosciences (Wilson 2013). According to their 2014 survey of 163 departments, about 27% of bachelor’s degree recipients and 28% of graduate degree recipients had found or were seeking jobs outside of the geosciences (Wilson 2014a). Most recently, according to their 2015 survey of 210 departments, about 26% of bachelor’s degree recipients and 25% of graduate degree recipients had found or were seeking jobs outside of the geosciences (Wilson 2015).

In order to sustain the atmospheric science workforce and avoid a bust, retaining experienced workers is as important as recruiting new workers. The results of the current study suggest that consequences of imbalanced supply-and-demand not only trouble recruitment and retention of new graduates, as Mass (1996) and Knox (2008)

warned: They also hinder the persistence of atmospheric scientists who have already obtained employment in the occupation, specifically by preventing them from filling their needs while staying in it. Several of these issues, like lack of hiring, overall lack of jobs, lower pay compared to other occupations, and prohibitive competition (Appendix E), fit Mass (1996) and Knox's (2008) warnings. Other factors, like a lack of security, degree and experience inflation, and the decline of work environments that the participants attributed to competition, are new to the atmospheric science literature on supply-and-demand. If working atmospheric scientists are unable to fill their needs because of the constraints imposed by such occupational factors related to oversupply, they may exit it in order to fill their needs, thus drawing valuable knowledge and experience away from the occupation. Additionally, if aspiring atmospheric scientists learn of poor working conditions or job availability that trouble atmospheric scientists who have already obtained work in the occupation, they may question majoring in atmospheric science.

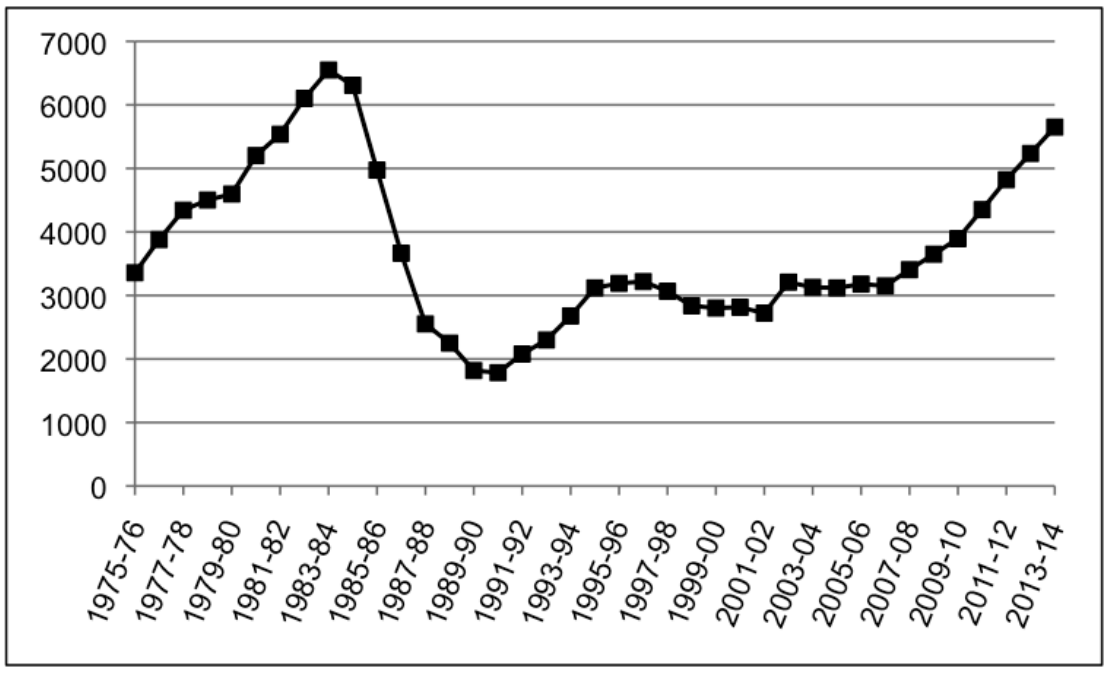

FIG. 5: Annual number of U.S. bachelor's degree conferrals in Geoscience instructional programs for the 1975–76 through 2013–14 academic years, compiled from data published in the NCES *Digest of Education Statistics*. Markers are placed for every academic year.

As the geosciences demonstrate, busts can negatively impact a discipline for decades, even after growth via new graduates is reestablished. Atmospheric science could be at risk of a bust due to unsustainable growth of graduates combined with relatively lacking demand, at least in some job types, and its effects. Simply monitoring annual conferrals and total jobs, and recruiting new majors, are not enough to ensure the health and productivity of an occupation. Retention of skilled, experienced workers is necessary in order to provide a valuable base of knowledge for all workers; provide mentorship opportunities for new workers; and drive innovation. In order to retain experienced atmospheric scientists, leaders in the field must understand problematic issues that workers face and address them in a relevant, meaningful way. In illuminating the occupational factors that can prevent atmospheric scientists from filling their needs

while staying in the occupation, the current study provides leaders with some valuable information on why atmospheric scientists might leave. The methodological details and further discussion below also suggest how more information could be gathered on atmospheric scientists who have worked or continue to work in the occupation.

4) STAYERS AND LEAVERS

The general structure of the exit experience and its accompanying themes and relevant meaning units reveal that leavers may be unable to fill commonplace needs while staying in the atmospheric science occupation (Appendix E). There is no reason to think that the needs to escape an undesirable work environment, interact socially, do meaningful work, have security, be physically present with loved ones, take care of loved ones, establish a family, or take good opportunities are unique to atmospheric science leavers. Many atmospheric scientists who have so far stayed in the atmospheric science occupation or will enter the occupation in the future will likely experience the same or similar needs. Furthermore, many of the factors that can prevent atmospheric science leavers from filling their needs while staying in the occupation are characteristic of the nature of finding employment and working in the occupation. Stayers would be subject to the same work environments, job tasks, schedules, salaries, geographic constraints, and educational, skill, and experience requirements as leavers. As discussed above, several of the participants even noted that they spoke with other atmospheric scientists about such concerns, and Downey et al.'s (2013) report on the NWS indicates that there has been concern about diminished and inadequate training, staff shortages, unsatisfactory leadership, and a "culture shift" (p. 43) toward integrating communication with forecasting

Theoretical extension of the research findings to stayers would not be illogical, as voluntary occupational turnover studies that sampled both stayers and leavers have found substantial overlap in their marital status; number of dependents; educational backgrounds; hours worked; attitudes toward their jobs, work environments, occupations, and careers; attractions to other occupations; and familial obligations (Neapolitan 1980; Kanchier and Unruh 1989; Cherniss 1989; Breeden 1993; Smart and Peterson 1997; Blau 2007; Carless and Arnup 2011; Sian 2013; Brown et al. 2015). Although the current study did not sample atmospheric science stayers, and thus only theoretical connections can be made between stayers and leavers, it illuminated commonplace needs and occupational factors that likely affect not just those who have left the atmospheric science occupation, but also those who have stayed in the occupation or will enter it in the future. Since many of the occupational factors highlighted by this study can make filling needs difficult while staying in the occupation, it is of utmost importance for the continued health of the occupation that leaders in the field recognize and, if possible, address their workers' needs.

6. Summary and conclusions

The purpose of this study was to understand the roles played by occupational factors in voluntary exits from the atmospheric science occupation. The study was guided by broad research questions that focused on the individual lived experience of voluntarily exiting the occupation: What is it like to voluntarily exit the atmospheric science occupation? How does it come about? Giorgi's (2009) descriptive psychological phenomenological methodology, which is based upon Husserl's philosophy of transcendental phenomenology, was used to structure the study. Semi-structured

interviews were conducted with 14 participants who self-identified as having voluntarily exited the atmospheric science occupation and were willing and able to describe their experiences in detail. The interviews were transcribed in full and the transcripts served as the empirical base for scientific phenomenological explication.

Phenomenological research culminates in the description of the general structure of the experience of interest, in this case the experience of voluntary exiting the atmospheric science occupation. For a leaver, the exit experience is that of filling needs that cannot be filled while staying in the atmospheric science occupation. Needs may derive from work, social, and personal spheres of life, and a leaver articulates and considers their needs against the nature of working in the atmospheric science occupation. Occupational factors like workplace environments, job tasks, interactions with co-workers, non-traditional schedules, lack of available jobs, and job insecurity drive the development of needs and prevent leavers from filling their needs while staying in the occupation. Since they cannot fill their needs amid the realities of working in the atmospheric science occupation, they must exit the occupation in order to fill their needs.

The central role of need fulfillment hearkens back to early psychological occupational turnover studies, which presented unmet needs as instigating turnover by causing dissatisfaction. Unfortunately, research into the role of needs stalled in favor of research into satisfaction, commitment, and other affective turnover variables, even though such variables consistently have shown only weak-to-moderate relationships with turnover. Phenomenological approaches promise to “freshen” social research, and accordingly, the current study has revisited and explicated the importance of needs to

voluntary occupational turnover. Needs and need fulfillment provide the structure of the exit experience, while dissatisfaction is not essential to the experience. Some of the participants were satisfied with their work in atmospheric science, while others were not, and even those who were unsatisfied noted positive aspects of their work. Thus, the current study demonstrates that, while needs may structure of the exit experience, they do not necessarily cause work-related dissatisfaction, and pursuit of that avenue likely will not prove any more fruitful in future turnover research than it has in the past. This major finding strongly suggests that future voluntary occupational turnover studies should re-integrate the roles of needs and need fulfillment into their designs, apart from attitudes.

This study marks the first time that voluntary exits from the atmospheric science occupation have been examined. The findings illuminated how various occupational contexts made the turnover experience possible. As such, I agree with other turnover researchers' recommendations that context should be of central focus in voluntary turnover studies, and samples should be restricted to single occupations to assist elucidation of the essential roles played by contexts. By restricting the current sample to only self-identified atmospheric science leavers, this study revealed that many of the facets that drive needs and/or prevent leavers from filling their needs while staying in the occupation stem from the nature of working in the occupation; imbalanced supply-and-demand that is skewed toward an oversupply of atmospheric science graduates; and economic instability. These contexts can make it difficult for atmospheric scientists to fill their needs by driving prohibitive competition, decreasing the number of available

jobs, and promoting undesirable work environments and rewards, and atmospheric scientists may eventually leave the occupation to fill their needs elsewhere.

This work adds to the small number of voluntary occupational turnover studies that sampled actual leavers rather than workers who merely intended to leave their occupations, and thereby provides valuable insight into the psychology of the actual exit experience. It also adds to the smaller number of voluntary occupational turnover studies that have utilized qualitative research approaches, and to the even smaller number of voluntary occupational turnover studies that have utilized phenomenological approaches. Description of the research design reveals that phenomenological approaches to human research are rigorous in collecting and explicating data. The cogent, empirically consistent findings demonstrate that phenomenological approaches have the power to accommodate the complexity of lived individual experience while helping researchers identify the general structure of an experience, which makes complexity manageable. The resulting structure fulfills Ezzy's (2002) and Morse's (1994) requirements for theorizing. Theorizing "is the real work of qualitative inquiry" (More 1994, p. 33). It includes sorting data; finding the most comprehensive, coherent, and simplest model for linking data to each other; and moving from the particulars of empirical data to a general structure. In abstracting general findings from particular instances in the data, theorizing decontextualizes data and gives researchers the power to recontextualize their findings in other instances. Morse (1994) notes that the process of phenomenological writing and re-writing in pursuit of the general structure of an experience satisfies the demands of theorizing and gives researchers the power to recontextualize their findings to other individuals in other situations.

Finally, I argue that, if the goal of turnover researchers is to understand the psychology of turnover, then qualitative or mixed methods rather than strictly quantitative methods should be used. As many turnover researchers have noted (Lee and Mitchell 1994; Maertz and Campion 1998; Lee et al. 1999; Mitchell and Lee 2001; Mitchell et al. 2001b; Maertz and Campion 2004; Morrell et al. 2004ab; Griffeth et al 2005; Holtom et al. 2008; Murtagh et al. 2011; Russell 2013; McGinley et al. 2014), no single accepted approach or framework has resulted from decades of largely-quantitative study of voluntary turnover, and many existing frameworks have become too complex to enhance understanding of turnover, on top of having only weak relationships and inconsistent predictive validity. Because the experience of voluntary occupational turnover is personal, interactive, complex, and contextual, quantitative studies of occupational turnover will likely continue to produce middling results that fail to illuminate the experience, beyond quantifying how much turnover is occurring and in what sectors or jobs it generally occurs, until they systematically take into account the findings of qualitative studies. Qualitative studies like the current study have shown much promise for illuminating the experience of voluntary occupational turnover in a meaningful, understandable way, and their findings have psychological and social meaning, which is even more motivating for action than numbers. I am confident that qualitative approaches will enable researchers to continue to advance understanding of voluntary occupational turnover in future studies.

The current study introduces detailed discussion of transcendental phenomenology and demonstration of a scientific phenomenological approach to the atmospheric science literature. Qualitative research approaches are a growing minority

in some areas of atmospheric science research, particularly in topics such as climate and weather hazards where communication with policy makers, stakeholders, and the general public is key. Qualitative approaches are designed to help researchers locate information-rich participants; uncover hidden aspects of topics of interest by empowering participants to speak freely and at length about their experiences with or perceptions of various phenomena; and accommodate complexity with the use of themes, models, and theories. Consequently, they are suited to exploratory study of phenomena that are not well understood. Phenomenological approaches in particular help researchers maintain openness to participants' descriptions, and they honor the complexity of human experience while making it manageable enough for research purposes by assuming that every phenomenon has an accessible core structure that can be found through imaginative variation and comparison of different concrete details. The elements of the current study's research design and the steps of the scientific phenomenological approach were laid out in great detail to assist other researchers who wish to employ qualitative approaches in studying other topics that are important to atmospheric scientists. This study also demonstrated the value of having a researcher explicate his or her epistemological and theoretical stances so that the research design and findings are even more traceable and understandable. This practice is also rare in the atmospheric science literature.

Over the past couple of decades, Mass (1996) and Knox (2008) have called for greater honesty about employment in the atmospheric science occupation to support investigation into supply-and-demand. This study answers those calls in a rigorous way, but it is not the only answer. A descriptive phenomenological study serves as both

"starting point and touchstone" (Crotty 1998, p. 85) in human research due to its openness to lived experiences. It is my hope that this study serves as a touchstone for future research into the occupation, and I give several suggestions for such work below.

7. Future work

As noted above, there is no reason to think that the needs and occupational realities described herein are unique to atmospheric science leavers. They likely affect atmospheric scientists who are currently working in the occupation, and they are likely to continue to affect atmospheric scientists who earn degrees and attempt to enter the occupation in the future. It is important for the health of the occupation that these factors—many of which were related to the nature of working in the atmospheric science occupation as well as imbalanced supply-and-demand—be addressed. Supply-and-demand was already a somewhat established topic of interest in the atmospheric science literature, although Knox's (2008) paper was the most recent discussion. Certain aspects of the nature of working in the occupation, especially operational forecasting, have been studied, often using qualitative approaches. These include: the role of the human forecaster in a highly automated forecasting process (Sills 2009); how forecasters are affected by the strengths and limitations of radar systems (LaDue et al. 2010) and rapid-scan radar data (Heinselman et al. 2012); how public sector forecasters create and communicate information about looming hurricanes (Demuth et al. 2012); how forecasters utilize model output (Evans et al. 2014); and what types of tools climate science "integrators" need to collaborate with decision-makers (Brugger et al. 2015). I hope that the current study promotes even more investigation of the occupation

to understand what it is like for degree-holding atmospheric scientists to work in it: What parts of working in the occupation do they find rewarding? What parts of working in the occupation do they find difficult? How do they fit together their work and personal lives? What does their work mean to them?

First, a similar phenomenological study should be conducted on atmospheric science stayers. This will reveal if extending the results of this study to stayers is appropriate. If such a study does tie together the experiences of stayers and leavers, other studies could more closely investigate concerning aspects of working in the occupation. For example, many of the leavers' exits were prompted by the appearance of unexpected opportunities or changes, and it is likely that stayers also will experience such events. A future study could focus on typical shocking events that initiate inside and outside the occupation, detailed by job type, and how managers of employing organizations could address them if they are concerned about shocks initiating unwanted turnover (Lee and Mitchell 1994; Holtom et al. 2008). For another example, I did not ask the participants to describe working in their new occupations in detail, as the focus of the current study was on the exit experience. Even so, the participants provided some valuable details about their new occupations, such as the attractions of recruitment, higher salaries, and more flexible schedules. Other voluntary occupational turnover studies queried leavers about their current work (Gottfredson 1977; Neapolitan 1980; Thomas 1980; Herrick et al. 1983; Perosa and Perosa 1984; Breeden 1993; Rathbun-Grubb 2009; Ahn 2016), and this could be done systematically in another study to provide more insight into the attractions of other occupations, which managers in the atmospheric science occupation may wish to consider or even emulate.

Second, the discussion in Sec. 5 revealed implications for general voluntary occupational turnover research, specifically in relation to continued investigation of work-related satisfaction, shocks, and decision-making. Because these aspects of the exit experience, especially satisfaction and shocks, have been largely investigated using quantitative methods, a mixed methods rather than purely qualitative approach would help connect the findings of a study of the experience of voluntary turnover from the atmospheric science occupation to other turnover studies more definitively.

Third, given that the needs and occupational realities experienced by the participants in this study seem commonplace, it is imperative that the outcomes of graduated atmospheric scientists are tracked more frequently than the AMS membership surveys, and in more detail than the NCES and BLS provide. Since technological advances and economic and political changes have the power to modify the occupation rapidly, graduation and employment trends cannot be meaningfully identified and evaluated when many years pass between surveys. Atmospheric scientists who are already working in the occupation, as well as aspiring atmospheric scientists who are concerned about how to succeed in their intended occupation, need up-to-date information on where atmospheric scientists are working, what tasks they do, how much money they make, and if they are leaving, in order to plan for their own careers.

The work of conducting semi-structured interviews, transcribing them in full, and analyzing their transcripts is intensive, and honing those skills take practice. I would like to see Mass (1996) and Knox's (2008) calls for the creation of an employment database answered, but I do not think it would be reasonable to suggest that such a large-scale project proceeds from a phenomenological or even an intensely

qualitative approach. I instead suggest that, as a start, a professional organization such as the AMS create a general survey to disseminate regularly to their members, as well as to educational departments and employers who could pass the survey onto their graduates and employees. This survey could elicit anonymous demographic, educational, and employment information as well as measures of atmospheric scientists' experiences in and perceptions of the occupation, such as their perceptions of intellectual challenge; appropriateness of their current jobs for their educational attainments; common duties and responsibilities; frequently used skills; and most rewarding aspects of their jobs (Czujko and Anderson 2015abc). At a basic level, this would help quantify how many degree-holding atmospheric scientists work in the occupation and how many work outside of it, and the circumstances under which they came to work outside of it could be elaborated. After some years, these efforts could quantify if atmospheric scientists are leaving at a greater or lesser rate than previously, and they could identify if there are certain job types from which atmospheric scientists are leaving at a greater rate.

The AMS could look to the AGI's Geoscience Student Exit Survey, which is disseminated through geoscience departments, and the AIP's Survey of Enrollments and Degrees and PhD Plus 10 Study. They might even be able to leverage their partnership with the AIP for help making, disseminating, and analyzing surveys. Additionally, Campion (1991), Morrell et al. (2004b), Trevor et al. (2007), and Allen et al.'s (2010) recommendations for surveying voluntary leavers could be relevant to a survey of degree-holding atmospheric scientists, whether they have left the occupation or not. Campion (1991) recommended allowing individuals to report multiple reasons for

turnover, either by choosing multiple responses to closed-ended questions or by answering open-ended questions. He made these recommendations to reduce bias, better capture the complexity of turnover, identify influential factors that tend to group together, and identify factors that do not appear to be relevant to the experience. He noted that regular survey administration and evaluation would allow interested parties to track changes in context over time, as the nature of working in an occupation will change over time. Morrell et al. (2004b) similarly recommended administering surveys regularly to capture changing thoughts about turnover and actual turnover trends. They also recommend emphasizing the two-way nature of information sharing, so that survey takers feel valued and involved in the research process. Finally, they recommended having consultation and guidance services available to elicit more detail from workers. Trevor et al. (2007) added that anonymous surveying is needed so that respondents feel comfortable revealing personal information, and that surveys must be structured to ensure that responses can be compared across respondents. Besides surveying leavers, Allen et al. (2010) also recommended holding focus groups with stayers and using other qualitative methods to gain an in-depth, contextual picture of workers' experiences and perceptions.

Campion (1991) and Morrell et al. (2001) warned that turnover is not always clearly voluntary or involuntary. They suggested that researchers ask workers directly to identify their types of exits and provide details about them, rather than rely on information from third parties such as their former employers. I make the same recommendations. As the current study demonstrates, communicating with degree-holding atmospheric scientists who have left the occupation can reveal many important

details about the nature of working in the occupation. Leavers may be difficult to locate if they discontinue membership with professional organizations, or if their former educational departments or employers do not record their exits or do not make such information available. Encouragingly, the current study demonstrates that accessing a hidden population like occupational leavers can be accomplished through snowball sampling if researchers can recruit well-placed informants and take advantage of social media. Additionally, the participants enthusiastically shared their experiences, and I expect that other degree-holding atmospheric scientists, whether they are working in the occupation or have already exited it, will participate in surveys if they feel like their input is valued.

It is beyond the scope of this study to recommend certain actions educational departments, employing organizations, or professional organizations should take to address occupational factors that prevent atmospheric scientists from filling their needs. Responses could include: measuring turnover amount and costs; reviewing career information provided to students; evaluating and possibly updating workflow and scheduling; updating training to better reflect actual working conditions; updating rewards programs; and investigating how organizational structures impact workers tangibly—for example, in their tasks, schedules, and autonomy—and intangibly—for example, in their perceptions of their work environments and job security. As part of such responses, leaders must recognize that atmospheric scientists integrate their work into their entire careers, along with their family, social, and personal roles, responsibilities, interests, and enjoyments, and they must address fulfillment of needs that originate both inside and outside the occupation. I also suggest that concerned

atmospheric scientists who wish to study the occupation speak directly with their students, employees, or members to gain contextual insight into how they view the impacts of occupational factors on their lives. For example, Lee et al. (1999), Mitchell et al. (2001b), Holt et al. (2007), Allen et al. (2010) and Burton et al. (2010) recommended that managers survey their employees about typical shocks and discuss them in early training to socialize new employees to reduce negative perceptions of them, and Holt et al. (2007) recommended that managers also survey employees about their scripts (plans of action) to anticipate how they might react to typical shocks. Similarly, Brown et al. (2015) recommended that educators socialize students into the realities of their occupations, through teaching, guest speakers, field trips, and internships, and de Croon et al. (2004) suggested that managers in high-strain occupations provide psychological resources such as counselors or stress management courses. Finally, for the atmospheric science occupation in particular, I suggest that the results of this study be tailored to the demands of a particular sector, organization or company, or job type to best address their workers' particular needs, as there is no "one size fits all" in voluntary turnover. Steps have already been made in this direction for the NWS (Downey et al. 2013).

8. Strengths and limitations

Transcendental phenomenology, which was founded in its contemporary form in the early 20th century, is a relatively young philosophy, and phenomenological research approaches based on it are even younger. The youth of phenomenological research approaches could be seen as a limitation, since they have not had the time to be widely implemented, and they do not have many examples in the literature compared to other

qualitative approaches. However, they are supported by a plethora of guidelines and demonstrations composed by active and passionate scholars who wish to ensure that phenomenological approaches are rigorous and expand their usage in human research. Especially recently, phenomenological approaches have been used to great effect to freshen and reveal new nuances in the experience of voluntary occupational turnover, as described in Sec. 1, and the current study continues that trend.

In natural science research, the researcher's relationship to an unconscious object of study is largely inconsequential. However, in research with human participants, "every mode of presence will have some impact on the human person who serves as a participant in research" (Giorgi 2009, p. 85). In particular, the researcher-as-research-instrument affects how participants construct their descriptions. This begins with the researcher's initial communication with participants about the study purpose, and extends through their interview questions. To minimize bias associated with my role as the research instrument, I approached each participant with the same survey and scripts; provided them with the same consent form; and adhered to the interview protocol so that all participants were asked approximately the same questions. I also delayed explicating individual interviews until all interviews were completed, so that findings from previous participants' descriptions did not color my questioning in further interviews.

I am a novice qualitative researcher. I have spent the majority of my university education steeped in quantitative research methods, and only began learning about qualitative approaches in 2014 after becoming interesting in the topic of voluntary exits from the atmospheric science occupation. The vocabulary, methodologies, and

perspectives of the human sciences were foreign to me, and to learn more, I engaged in an extensive review of relevant literature and took two semesters of graduate-level courses in qualitative research methods in an educational psychology department. I also chose to use a systematic phenomenological methodology, which Osborne (1994) advises for new phenomenological researchers (Osborne 1994). Despite diligently committing myself to learning more about human science perspectives and qualitative research approaches, I cannot guarantee that my interviews were perfectly open and that my explication perfectly captured the voluntary occupational turnover experience. To combat these weaknesses, I continually immersed myself in the literature about epistemologies and theoretical perspectives; read about the backgrounds and implementation of qualitative research approaches in general and phenomenological research approaches in particular; practiced interviewing to improve my questioning and listening skills; and verified a portion of my explication when possible with the participants.

Specific to phenomenological qualitative studies, there is no way to verify that I bracketed completely or correctly, since the *epochè* is a purely mental process (Giorgi 2009). Although Merleau-Ponty (1962), Crotty (1998), and Giorgi (2009) acknowledged that a complete transcendental reduction is not possible—since, at the very least, description draws on language—Giorgi (2009) held that the psychological phenomenological reduction is an attainable attitude of full attentiveness, a "heightening of the present" (p. 93). It is not an unrealistic attempt to do away with past knowledge, but is instead an attempt to distinguish between past and present, which is

attainable (Smith and McIntyre 1982; Osborne 1994; Giorgi 2009). In this way, phenomenology allows researchers to "freshen" their perspectives on perhaps commonplace experiences of interest by calling into question what is taken for granted:

> To take a fresh look at phenomena is, of course, to call into question the current meanings we attribute to phenomena. Phenomenology, it is often said, calls into question what is taken for granted. (Crotty 1998, p. 82)

To bracket as fully as possible, I followed Giorgi's (2006, 2009) recommendations and I kept the *epochè* at the forefront of my mind throughout data collection and explication. I relied on the interview protocol during data collection; used descriptive and in vivo coding to minimize my interpretation during data explication; repeatedly checked my explication against the participants' interview transcripts; engaged in member checks; and provided substantial quotations in this write-up to ensure that the results were based on the participants' descriptions rather than my disciplinary interpretations. It is my hope that these study details and quotations help readers evaluate the veracity of my bracketing.

As Mobley et al. (1979), Campion (1991), and Hom et al. (2012) noted, voluntary and involuntary turnover are not necessarily as dichotomous as their typical usage in turnover studies implies. Adam and Valerie's experiences exemplify this difficulty. His option to work remotely and her funding both were terminated, yet they each still identified as a voluntary leavers. Additionally, Matthew and John feared impending lay-offs, and their exits could be viewed as "forced" in this respect, yet they also identified as voluntary leavers. Questioning whether or not the participants' exits were "really" voluntary is irrelevant to their lived experiences, since they identified as voluntary leavers, and the *epochè* is a safeguard against this line of questioning.

Nevertheless, the use of the *epochè* does not eliminate the difficulty of differentiating between voluntary and involuntary turnover, and it is left to future studies to investigate that relationship.

The *epochè* also guards against questioning if the participants "really" could not find ways to fill their needs while also staying in the atmospheric science occupation. Again, this is irrelevant to their lived experiences of voluntarily exiting the atmospheric science occupation. I partially addressed this line of questioning by asking the participants to evaluate the avoidability of their exits, but I abstained from pressing the issue with further questions, as it may have diluted understanding their actual lived experiences.

Human researchers who use qualitative inquiry, including those who employ phenomenological approaches, are concerned with the meanings and interpretations that people assign to their experiences (Ezzy 2002). This complicates evaluation and extension of the results of any given qualitative study, since "meanings and interpretations constantly change in response to the changing conditions of contemporary social life" (Ezzy 2002, p. 53). It is important for readers to keep relevant contexts in mind when evaluating this study. As discussed in Sec. 5, the participants graduated, looked for work, obtained work, and/or exited the atmospheric science occupation during the Great Recession. Difficulties related to the Great Recession, such as overall economic downturn and a NOAA hiring freeze, prevented them from filling their needs while staying in the occupation. The participants also graduated, looked for work, obtained work, and/or exited during a time of documented oversupply of atmospheric science graduates. As discussed in Sec. 5, competition likely limited the

number of jobs available, kept salaries low, and inflated educational and experiential requirements. Contexts that will affect current and future atmospheric scientists may differ from these contexts. For example, growth of the job market, enhanced funding, changes in workplace structures, and/or a decrease in the number of graduates could remove restrictions to finding jobs in the occupation, and could create conditions where some needs are more readily filled while others are not. The phenomenological explication addresses limitations related to changing contexts by enabling researchers to move beyond the concrete details of participants' descriptions and uncover broader, more stable structures of an experience of interest. This type of theorizing, along with the provision of transferability through thick description, allows the findings to be recontextualized as necessary (Morse 1994).

The meanings and interpretations that people assign to their experiences are personal, and they will be related to the characteristics of the sample. Snowball sampling produced a sample of white, early-career, American atmospheric scientists. Their ages ranged from 22 to 33 at the times of their exits, and they worked for atmospheric science companies and organizations based exclusively in the U.S. The preponderance of "Generation X-ers" and "Millenials" may limit the extension of the study's findings to older leavers, and the homogeneity of the sample may prevent extension of the findings to atmospheric scientists with different ethnic backgrounds and/or who have lived or worked outside of the U.S. The relatively young ages are perhaps not unexpected, given that many other studies have found that younger workers tend to leave more often than older workers (Rytina 1982; Sehgal 1984; Cabral et al. 1985; Markey and Parks 1989; Harper 1995; Macdonald 1999; de Croon et al. 2004;

Schniper 2005; Parrado et al. 2007; Carless and Arnup 2011; Hwang et al. 2011; Howes and Goodman-Delahunty 2015).

Furthermore, the participants largely worked as weather forecasters, broadcast meteorologists, and research meteorologists (Appendix D), while atmospheric chemists, atmospheric physicists, climate scientists, and other types of workers who fall under the broad "atmospheric scientists" classification described in Sec. 1 were not sampled. Thus, insight into the effects of heterogeneity on exits is limited. Again, phenomenological explication addresses limitations related to sample homogeneity by enabling researchers to look beyond the concrete details of the participants' descriptions, and phenomenological theorizing allows the findings to be recontextualized as necessary. It is also promising that the general structure accommodated participants who attended different universities, worked in different sectors of the atmospheric science occupation, and were up to a decade apart in age. However, because the findings were founded upon empirical data collected from a rather homogeneous sample, more diverse samples in terms of age, ethnicity, cultural background, and job type could reveal different components or nuances in the general structure of the experience. For example, it is possible that different needs would be found in different types of employment, or that barriers to need fulfillment are especially restricted to certain types of atmospheric science jobs. This should be investigated in future studies.

As discussed in Sec. 2, retrospective accounts of an experience can be subject to recall bias. In particular, because several years had passed between the majority of the participants' exits and their interviews, they were able to draw upon substantial

experience in their new occupations and other spheres of life to describe their exit experiences. In future studies, I would control for the time lag between exit and interview, and possibly hold it to a year at maximum, to minimize this type of retrospective bias. However, anti-introspective psychologists hold that real-time decision-making—such as the decision to exit an occupation—is largely unconscious, and individuals reconstruct their thought processes post hoc to give reasons for why they did what they did, when in actuality, most if not all of their decision-making was unconscious (Krieshok 1998). Given Krieshok's (1998) warning that real-time decision-making is largely unconscious, as well as Morrell et al. (2004a) and Trevor et al.'s (2007) warnings that retrospective accounts are likely the only way to gain complete and valid pictures of the turnover process, I would not search for participants who were in the middle of the process of exiting.

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APPENDIX A

Subjectivity statement

I began this study because I wanted to understand what occupational factors atmospheric science push atmospheric scientists to voluntarily leave the profession. I first hit upon this issue when reading Knox's (2008) paper on supply and demand and the employment of atmospheric science bachelor's degree recipients. Specifically, I was struck by his Table 3, which showed that four percent of bachelor's degree recipients sampled between 1997 and 1999 and six percent of sampled between 2003 and 2005 were working outside of the occupation. The two data points, not particularly inspiring on their own, struck me, because I was considering leaving the occupation due to disillusionment with academia, and I knew how difficult that decision could be. Like many other atmospheric scientists, I have wanted to work in the occupation since childhood. I've never encountered this same type of persistent work-related passion except in astronomers and physicists. This longtime commitment was complicating my decision to leave the occupation, and although I was considering leaving it, I also simultaneously was searching for ways to stay in it. Specifically, I was searching for a dissertation topic that fit my education- and mentorship-related interests and would enable me to continue my graduate studies in the atmospheric science occupation. The topic of voluntary exits from the atmospheric science occupation fit both needs. Thus, I desired to know: What would cause people who had devoted years to pursuit of their childhood passions to leave the atmospheric science occupation? I hypothesized that exits would be motivated by negative factors related to working in the occupation, and I

specifically considered low pay, shift work, and lack of societal respect to be the most likely candidates, based on what I had seen of the occupation.

As I searched onward from Knox's (2008) paper, I discovered that I could not find more corroborating numbers. I could barely find any employment numbers at all! I contacted various atmospheric science departments and found that they either did not record such data, or they were not willing to send it to me even in anonymized form. I wondered, did they not want to give me the numbers because many graduates had left the occupation? I began to talk about this issue with other atmospheric scientists, and I everyone I talked to knew of at least one person who had left the occupation. Many of them referenced the same negative factors that I had surmised.

After talking informally with many others about this topic, I decided to do a qualitative study. I could not find pre-existing employment numbers, so that avenue was closed. I considered heeding Knox's (2008) call to build a grassroots employment database, but I decided this would not be sufficiently technical for a doctoral project. Furthermore, employment numbers would not explain why leavers were leaving: It would explain who was leaving, and what sector they were leaving from, but no more than that. I considered disseminating surveys asking leavers indicate which from an array of reasons had motivated them to leave, but this method felt anemic. What would this reveal except the choices I had put down in the survey? I needed better methods to dig into this issue. An education-minded atmospheric scientist suggested qualitative inquiry, and she lent me Creswell's (2012) overview of five traditions in qualitative inquiry: Narrative research, phenomenology, grounded theory, ethnography, and case study. As a mathematician, I found myself getting swept away in the new logic of the

traditions. Additionally, I like being nontraditional, and I enjoyed the thought of doing a qualitative study in a traditionally quantitative field. At the time, I thought that the five traditions Creswell (2012) laid out were the only options, and I hit upon phenomenology as the best for my study. I was studying an experience! Phenomenologists aim to be as rigorous as mathematicians! Phenomenology is so rigorous that atmospheric scientists will accept it! What could be better? Over the next year, in digging deeper into qualitative inquiry and speaking with several social scientists, I considered different methodologies and abandoned phenomenology for being relatively unpopular and overly technical compared to other approaches. Finally, after convincing myself through two semesters of study and argument that a phenomenological approach was, in fact, the best approach for my study, I contentedly settled on it again.

I here highlight several points from the above discussion that could affect my findings. For one, I love philosophical phenomenology and descriptive phenomenological research approaches, specifically Giorgi's (2009) approach. This love at times prevents me from acknowledging that there are other ways to go about this study that would be also effective and reveal other facets of the experience of voluntarily exiting the atmospheric science occupation. I have to keep in mind that it is fine to argue *for* phenomenology, but that does not necessarily mean I need to argue *against* other approaches. Second, my foray into this study was driven by the assumption that atmospheric scientists voluntarily leave the occupation because of negative factors related to working in the occupation. That is drawing on my own experiences in the occupation and my casual discussions with others, but it is not a good

assumption to bring into a scientific study. It is possible that leavers have amazing experiences in the occupation (as several participants did in fact tell me) and left for other reasons. It is more rigorous for no assumptions to be made at all. Third, I am an atmospheric science "insider:" I have honed my professional skills by interning at television stations and forecast offices, researching tornadoes, and earning bachelor's and master's degrees in atmospheric science and meteorology. As an insider, I can use my social network to identify potential interviewees, and my educational and professional background may help me formulate relevant questions and understand participants' descriptions. However, my shared background with the interviewees may make them hesitate to answer my questions openly, and I may find myself jumping to conclusions based on my own experiences rather than their descriptions. My relative newness to qualitative inquiry could enhance these weaknesses, as I am less comfortable with their vocabulary and frameworks and I have not had many years to practice their methods and consider myself the research instrument.

These difficulties are why I am so committed to the phenomenological approach. Bracketing goes a long way toward containing my biases. The requirement of going to multiple participants with varied backgrounds and asking them open questions reveals factors about the exit experience that I never even thought about, provides valuable context, and broadens the findings. The psychological phenomenological reduction reminds me that my attitude in conducting the study is not the only possible attitude, but is an essential attitude to start research into this topic. The eidetic reduction instills my findings with rigor and allows them to be considered for other atmospheric science leavers not involved in my study, with the description of the general structure

serving as a nice capsule to expand study of this topic. The guidelines allow my steps to be tracked. Above all, the in-depth discussions of phenomenology that Husserl, Giorgi, and others have provided gives such a technical background that even I as a new qualitative researcher can succeed, both in performing my research with integrity and communicating the rigor of my research to others.

APPENDIX B

Interview protocol

Consent process

Thank you for your time and your willingness to participate in this research project. I am researching the atmospheric science occupation, including meteorology. Specifically, I would like to understand the experience of voluntarily exiting the atmospheric science occupation. To gain understanding, I am interviewing individuals who hold atmospheric science degrees and do not work within the occupation by choice about their experiences of deciding not to pursue work in the atmospheric science occupation and acting upon those decisions. I would like to learn: What aspects do these experiences have in common? What influenced these experiences? How do participants feel about their experiences?

(Review Consent Form with participant.)

Introduction

Some of the questions I am going to ask you during the interview may be broad by design, and you may volunteer any detail that you wish to answer them. You may ask me for clarification on any of my questions that you do not understand. You also may decline to answer any of my questions.

I will also be taking notes during the interview.

Do you have any questions before we get started?

Interview questions

1. Can you describe your background in atmospheric science?
    a. When did you first become interested in the weather?
    b. When did you first become interested in atmospheric science/meteorology?
    c. When did you first become interested in atmospheric science/meteorology as an occupation?
        i. What motivated you to become interested in atmospheric science/meteorology as an occupation?
            1. What types of jobs interested you?
            2. What did you want to accomplish?
            3. Were there any influential others? (parents, etc.)
    d. How did you go about pursing atmospheric science/meteorology as an occupation
        i. Education
        ii. Internships
        iii. Miscellaneous
    e. What did you *expect* your experience in the occupation to be like?
    f. What was your last job in the occupation?
        i. How did you get it?
        ii. Can you describe it?
2. Can you describe, in as much detail as possible, your experience of exiting the atmospheric science occupation?

a. Was there anything about your educational background that impacted your decision to exit the occupation? If so, could you describe how it/they affected your experience?
b. Was there anything about your employment background that impacted your decision to leave the occupation? If so, could you describe how it affected your experience?
    i. Was there anything about your anticipated employment that impacted your decision to exit the occupation? If so, could you describe how it affected your decision?
c. Were there any people who impacted your decision to exit the occupation? If so, could you describe how they affected your experience?
d. Were there any events that impacted your decision to exit the occupation? If so, could you describe how it/they affected your experience?
e. Was there anything else that impacted your experience? If so, would you be willing to describe how it/they affected your experience?
f. What motivated you to enter your new occupation in particular?
g. How did your experience affect your personal life?
h. How did your experience affect your work life?

3. How do you evaluate your experience of exiting the atmospheric science occupation?

a. Was there anything that could have happened at the time of your decision to motivate you to stay in the occupation? If so, could you describe it/them?
b. Would there be anything that would motivate you to consider returning to the atmospheric science occupation in the future? If so, could you describe it/them?
c. What do you think your experience says about the occupation of meteorology? (In other words, how does your experience lead you to evaluate the occupation?)
d. Do you think your experience of exiting the occupation was typical or unique for atmospheric science leavers?
e. How would you evaluate your current occupation?
    i. Has your background in atmospheric science impacted you in your new occupation? If so, how?
f. What advice would you give to another person who's exiting or considering exiting the atmospheric science occupation?
g. Do you still consider yourself a meteorologist?

Closing remarks

Now that we are done with my prepared questions, I'm going to summarize how I understand what you've described to me. (Summarize here.) Does that sound right to you? Do you have any questions you'd like to ask me about this research project, or any additional information that you would like to add? Are there any questions that I should have asked that we didn't talk about?

If you would like to contact me later, I can be reached at [phone number redacted] or akkis@ou.edu. Would I be able to contact you with questions that come to up as I'm transcribing and analyzing this interview?

APPENDIX C

Consent form text

Signed Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

I am Amanda Kis from the University of Oklahoma School of Meteorology and I invite you to participate in my research project entitled Investigation of Voluntary Exits from the Atmospheric Science Occupation. This research is being conducted at the University of Oklahoma. You were selected as a possible participant because you identified yourself as meeting the criteria for study and expressed interest in being interviewed. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to understand the roles of occupational factors in the experience of voluntarily exiting the atmospheric science occupation.

How many participants will be in this research? About 30 people will take part in this research.

What will I be asked to do? If you agree to be in this research, you will be asked to respond to a series of open-ended interview questions about your experience within and exiting the atmospheric science occupation with as much detail as you would like.

How long will this take? Your participation will take approximately one to one-and-a-half hours.

What are the risks and/or benefits if I participate? It is possible that you may experience psychological or emotional unease in reflecting on your experience of voluntarily exiting the atmospheric science occupation. This is more likely if your experience was difficult for you. If you request that your participation be terminated, or if the researcher perceives that you are experiencing undue stress, the interview will be terminated.

You may experience calmness and/or contentment as you reflect upon your experience of voluntarily exiting the atmospheric science occupation and build new understanding of your experience.

Will I be compensated for participating? You will be reimbursed for your time and participation in this research with a $10 gift card to the restaurant or store of your choice. This compensation is dependent on completion of the interview. The researcher will discuss your choice with you after the interview is complete, and will deliver the gift card to you either in-person or via mail within two weeks after the interview.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institution Review Board will have access to the records.

You have the right to access the research data that has been collected about you as a part of this research. However, you may not have access to this information until the

entire research has completely finished and you consent to this temporary restriction.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Will my identity be anonymous or confidential? Your name will not be retained or linked with your responses unless you specifically agree to be identified. The data you provide will be retained in anonymous form until the end of the study and then destroyed unless you specifically agree for data retention or retention of contact information at the end of the research. Please check all of the options that you agree to:

I agree to being quoted directly. ___Yes ___No

I agree to have my name reported with quoted material. ___Yes ___No

I agree for the researcher to use my data in future studies. ___Yes ___No

Audio Recording of Research Activities To assist with accurate recording of your responses, interviews may be recorded on an audio recording device. You have the right to refuse to allow such recording without penalty.

I consent to audio recording. ___Yes ___No

Will I be contacted again? The researcher would like to contact you again to recruit you into this research or to gather additional information.

_____ I give my permission for the researcher to contact me in the future.

_____ I do not wish to be contacted by the researcher again.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at [phone number and email redacted]. You can also reach my committee chair, Dr. Susan Postawko, at [phone number and email redacted].

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).

You will be given a copy of this document for your records. By providing information to the researcher(s), I am agreeing to participate in this research.

Participant Signature	Print Name	Date
Signature of Researcher Obtaining Consent	Print Name	Date

APPENDIX D

Summary of participants

Pseudonym (age; years since exit)	Atmospheric science education	Atmospheric science work (sector; years)	Post-exit occupation
Matthew (30; 3)	B.S. meteorology	Forensic meteorology (private; 2) Research, training, and development (public; 7)	Computing
Linda (32; 1)	B.S. meteorology	Weather forecasting, customer support, and supervising (private; 9)	Customer service
Michael (27; 0.5)	B.S. meteorology	Software development (private; 0.75) Research, training, and development (public; 2)	Computing
Adam (28; 4)	B.S. atmospheric science	Software development (private; 2)	Computing
Danny (24; 1)	B.S. earth science with emphasis in meteorology	Instrumentation and support (public; 5)	Computing
John (29; 2)	B.S. atmospheric science	Weather forecasting and media (private; 8)	Business and financial operations
Becky (31; 4)	B.S. atmospheric science	Weather forecasting (public; 8)	Management

Maggie (30; 0)	B.S. meteorology	Weather forecasting (public; 3.75)	Physical science
Kim (26; 1.5)	B.S. meteorology	Weather forecasting and media (private; 1.75)	Information technology and customer service
Xavier (22; 4)	B.S. atmospheric science	Weather forecasting (public; 2.5)	Computing
Jacob (25; 4)	B.S. meteorology	Weather forecasting and media (private; 2.5)	Media
Valerie (29; 4)	B.S. meteorology	Weather forecasting (private; 3.5) Research, training, and development (public; 4)	Media
Courtney (30; 2)	B.S. meteorology M.S. atmospheric science Ph.D. atmospheric science	Research and education (academic; 8)	Primary and secondary education
David (31; 4)	B.S. meteorology	Weather forecasting and media (private; 8)	Management

"Age" gives the participants' ages at the times of their exits; "years since exit" is the number of years between the participants' exits and their interviews (a value of 0 means that the participant was in the process of accepting a job offer to work in another occupation at the time of their interview). Pre-exit atmospheric science work descriptions are consistent with the Bureau of Labor Statistics' *Occupational Outlook Handbook*, and general post-exit occupations are consistent with the Standard Occupation Codes.

APPENDIX E

General themes and selected relevant meaning units, by participant

Need to escape an undesirable work environment
Michael
And that was another big part of why I left, is that I really— So the organization I thought I knew about really did not exist anymore. And these types of practices had really started to show their ugly heads. **So if you were to summarize, based on everything you've told me, what motivated you to transition, would you say it was frustrations with the bureaucracy and the culture?** Kind of. That was kind of the nail in the coffin, I guess I mean. When I was working full-time after having all that experience in the public sector and seeing it wasn't just me— Everyone I graduated with had the same issues I had. They had gotten internships at TV stations and everything and whatnot. And then with the economic downturn, there were just so many of us with meteorology degrees that could just not find work, period. And so that was disheartening. And then, I feel like it's been compounded because this year I was a kind of capstone mentor for some local university seniors. And I've met up with quite a few of them and I've been trying to keep tabs on them, Facebook and everything. And it seems like that's just how everyone is right now. Everyone graduated with this degree that's really hard to get and then it's just like, you get this one opening and get 500 applying for it. And so that was what really started turning the gears, where I'm like, ok, maybe I thought I had it figured out, and that was a big test. Maybe I was completely wrong. And then the public sector is always kind of where I wanted to be, but then getting into [organization], I realized that in those just couple of years that I was gone and in grad school, removed me from how things were going. Things have really rapidly changed, and I don't think for the better. And so I'm the type of person where I don't like being put in a box like that. I like to be able to do research but not have to worry about, am I going to step on someone's toes? Or, how is this going to sit with the organization? And that was one thing. I feel like you spend this time doing these papers and doing research and when you're in an organization like that, you have to be careful of what you say and what you do. And so that was disheartening, on top of just seeing the morale. The public sector people, they're all like me. You want to be able to help and you get into it because you really fundamentally believe that you're doing a really good job. But then, when the government is making you take forced overtime and they're not replacing any staff that leaves, leaving people high and dry in terms of, well, where is the future going? It destroys the culture. And so that was the other big thing where I'm just like, I don't know if I want to be part of this now, because the public sector is just going through too many growing pains.

Danny

And I was getting tired of a lot of the politics that were going on within the weather side of things.

I really started to sit down with my contract manager and discuss with him ways to change up my workload so that it didn't wear on me the same way. We tried a couple of different things. I would pass reports off to some other people and I would focus more on actual testing of instruments. Or I would change some of the shifts that I was working so I was there at different times. And we tried a couple of different things and it just didn't change. I was just always unhappy.

It wears on you after a while, to where I absolutely hated what I was doing. I would come home in the evenings and not want to go to work in the morning. It's tough, and I don't want to work, I didn't want to work in an environment like that. And in order to get out of it, I had to switch fields.

John

Like I had just the crappiest crap you could ever crap. [laughs] So things just started deteriorating on a slow downward trend at this job. It took years.

I was just like, [sighs] I'm really getting sick of what I'm doing. And I started looking for other jobs.

We got to the point where, ok, you want to do something new with your life. Weather is pretty much done.

Maggie

So it was actually when I was taking those courses and learning about the severe weather warning process that I decided that I knew the public sector was not going to be for me. And it was for a few reasons. One, I had already been talking to some of the forecasters who had been in a lot longer and were doing the 24 hour shift. The interns at our office, we only do day shifts and evening shifts. We don't do mids. And I know just from offices that have the different schedules— But we, so I haven't had to do a midnight shift. So, but listening to the forecasters who do that— And they were talking about how, when I come off of my mid shifts, I lose days on it because I am adjusting back to a sleep schedule. I just sleep for days. And talking about the toll it takes on their body and their mental outlook on things. And just listening to all that, it was already starting to bother me for a full career in this. And then I started taking the courses for putting out warnings. It really bothered me because I do not like the idea of having people's lives in my hands. If I screw up on a warning, people could die. And so that really was bothering me. And that actually was a huge decision factor in me not wanting to stay with the public sector, because I did not want to be put in warning situations. The other side of that is we would be called in for severe weather. And I like to joke that the public sector has it backwards. When severe weather happens, we're the ones that

like to be out there watching it. But where are we? Stuck in front of a computer in an office. We don't get to see it. So it's kind of a backward way of thinking about it, because we're the ones that love it and we can't ever see it. So our experience with actually seeing it is, oh, it's coming! Let's see if we can get a glimpse of it out the window before we have to go back in and focus on this. But it's weird with that. But I learned also from that experience of having to go into the office every time severe weather happened: I like to be an observer of it. I like to see it. I don't like to forecast it. I also, I'm single. I live alone. I have two dogs and they're both scared to death of storms. And so I worry about them because, since there's nobody else here, if there's something headed directly for my house, and I have to be at work, there's no one to take care of them and put them in a safe place to avoid any kind of disaster. So that is one of the things that worries me about it. And I just, don't like to be stuck in the office when it's going on. I like to be at home. And so I got to the point where I was dreading severe weather, because, if it was my day off, I knew I was going to be called in for it. Where if I was already there, I knew I was going to have to stay late. And I ended up starting to resent the job a little bit, because I didn't want to be there. I wasn't interested in the office aspect of it. And I ended up starting to resent the job a little bit, because I didn't want to be there. I wasn't interested in the office aspect of it. I ended up starting to use my leave just to leave the office and come home. It got to the point where I was not happy. And since I wasn't happy with my work life, I was not happy in my personal life. I wasn't doing anything. I ended up just staying home all the time. I wouldn't say I was depressed, because I wasn't. I just, I didn't have a social life because I wasn't happy. So it was, I kind of went into a little bit of a downward spiral with it. And I just knew that this was not the career that I needed for the rest of my life.

So about November, I was like, I don't think I'm going to stay here. And then by April to June of the next year, I'm like, yeah, I'm not staying here. I'm actively looking for another job now.

And their reasoning is the same as mine. They don't want to be in an office. They don't want to do the shift work. They want to be out doing other things.

Xavier

No, very immediately I began to feel impacted by it. Because it gave me this sense of a very negative work environment and there were very few people who were very active and engaged.

So it was a little bit of a challenge, and I very much kind of feared myself being stuck in a career where I wasn't (a) enjoying my time and (b) wasn't challenged and continually growing and learning, and in an environment of like-minded people.

So I considered very seriously just dealing with it. And that only lasted for a few days [laughs] because there's no sense in kind of being stuck in a career that I just

did not enjoy. And it was not at all any of the leadership personnel or any of my co-workers. It was just the general ambient environment that I found myself in was very, very unpleasant.

It was overwhelmingly, the sensation was, I don't want to be here 30 years down the road, checking Facebook at four o'clock in the morning on a Friday night because I'm working an overnight shift and there's no forecast to do. That was motivating enough for me to just say, I need to quit.

If you're upset, then there's no sense in spending 50, 60 years of your life doing this thing that you're just bummed out about and hate going to.

Jacob

And specifically the second time around, the second year I went back, I was certainty not miserable, but I vividly remember opening the doors of the building and going, oh no! I've got another day to do this.

And there was very little communication between the co-workers. So it was just a very odd work environment. And, admittedly, I was a new employee, so it was understandable that I wasn't able to keep the same pace as everybody else. But I was just constantly feeling rushed and pressured. And it was supposed to be a nine hour day, and it would usually be 10 hours days for me. And so I also had some personal things going on at the time. But, yeah, I was very miserable there. So after the first six weeks, I put in my one month notice and then I was out of there.

I did have a conversation with my boss before I put in my notice about how unhappy I was. And I think he probably said, well, it's going to get better as you're here longer, but he obviously wasn't going to concede anything. I think that job would've been— If they didn't ask so much of you every day, where I felt like I didn't even have time to take a break or a breath…

I did feel like I failed, but I also was— At that point, it didn't matter to me, because I was just so relieved that I was quitting, that I was going to be done.

Courtney

I do think that another contributing factor was— I mean, I had some events towards the end of my career in grad school that were super frustrating, and I got kind of jaded on the whole academia thing. I just had a few weird things here and there. [sighs] The department I was at definitely kind of played favorites. And my advisor kind of played favorites. He wasn't doing it intentionally, but he definitely… For some reason, there were just certain people that got a hand up the ladder. And there were a lot of us that— And I kind of thought I had imagined all of this, and I got to talking about it with one of my other friends that defended around the same time as I did. And there were just a lot of instances where we felt— It wasn't just me, where I felt like maybe other people were given unfair advantages because of… A

lot of times it was like the faculty would pick somebody that was the mini-them. And my advisor definitely did that with one of my co-workers. Definitely picked, oh, this is a mini-me. And so that and the whole funding thing was just— Because right at the time I graduated it was just like, there's no funding for anybody to do anything. And both of those experiences were just kind of a real turn-off. I would not have stayed there, for sure. If it was between staying there and leaving academia, I definitely would've left, because I was… Some of the experiences, I was just over it. [laughs]
Kim
I was telling him, I can't do this. [laughs] This is getting to be a bit much. And so he pestered me for at least a year to quit and join his company before I finally did. I wasn't really optimistic. I kind of was just so frustrated with the job that I just went, ok, fine. So I touched my resume up, threw it at the contracting company, and I got a job offer about two months after that.
Valerie
So my whole time at my organization, I was always looking for a job, because I knew that my job could go away at any minute. And plus, I didn't want to do that forever. I was like, I'd like to do something a little more permanent, here in [state], where I can go to work every day. **And, and you said one of the things that also motivated you to look is that the job wasn't what you wanted forever?** Yeah. My impression of that job that I was in— My title was research associate, and kind of the vibe that I was getting from that job was, it was the type of job you took after you got your master's degree, and you worked in that job, you got some experience, and then you kind of moved on to something else. You might get a federal position within [company], or maybe a federal position in another agency. But it was kind of that foot-in-the-door to maybe working for the government.
Need for social interaction
Jacob
I was pretty gung-ho at that point about getting out of there. And part of it was, I was living away from home. I was working weekends— That was another big thing. It's amazing. We live in a 24/7 society. If you're stuck working weekends on a full-time job, that's still very tough to deal with, because so much of social life happens on the weekends.
Kim
But then on days that there wasn't severe weather, you just sat in your little studio recording for nine hours and then you went home. And so that part started to wear

on me, because I consider myself a pretty social person. And there would be a full week where I wouldn't see anyone. Maybe I would see my boss when I came in, but we all sat in our recording studios recording, because there'd be so much work to do that we wouldn't see each other. We'd send each other emails and that was kind of it. And so you're sitting in this little three-by-three cube with a computer and a microphone for nine hours a day, five days a week.

My weekends were Tuesdays and Wednesdays. So I didn't even get the same weekends as my friends who had regular corporate jobs. And so it got really strained after about a year. It was just the same old thing.

But it just got to be too much for me after a while. It was just too anti-social.

I needed some more social interaction in my life was the big thing. I worked 1 p.m. to 10 p.m., Thursday, Friday, Saturday, Sunday, Monday. And so I'm out at work when all of my friends are getting together for dinner or what have you. I can't do anything on the weekends because usually I would work a slightly earlier shift, and so I would be gone just the whole day. And so I never really saw anyone. I kept having to turn down invitations to things. So it got to the point where you just stop getting invited because you can never go. People figure out you are never available at the times they do things.

Need for meaningful work

Michael

And then the public sector is always kind of where I wanted to be, but then getting into [organization], I realized that in those just couple of years that I was gone and in grad school, removed me from how things were going. Things have really rapidly changed, and I don't think for the better. And so I'm the type of person where I don't like being put in a box like that. I like to be able to do research but not have to worry about, am I going to step on someone's toes? Or, how is this going to sit with the organization? And that was one thing. I feel like you spend this time doing these papers and doing research and when you're in an organization like that, you have to be careful of what you say and what you do. And so that was disheartening, on top of just seeing the morale.

The public sector people, they're all like me. You want to be able to help and you get into it because you really fundamentally believe that you're doing a really good job.

Danny

But it wasn't really what I wanted, because it wasn't forecasting. It was physical science, it was instrumentation and electrical engineering, that type of thing, but it wasn't forecasting. So I don't think I was ever truly 100 percent happy with doing that. I mean, I very much enjoyed it, but it wasn't exactly what I wanted to be doing. It wasn't the forecasting, it wasn't using what I had learned for three-and-a-

half years of school.

As a contractor, there's little to no room for promotion. You kind of get stuck where you're at.

I gave the meteorology thing a chance. It just wasn't moving. It didn't have the career prospects I was looking for…

John

This is the point where things start going downhill because I'm not doing TV. I'm doing the newspaper weather pages at this point. So we're doing national maps, forecast text, and the assembly of the pages, and assorted other tasks like tailoring website information for TV stations. A lot of TV, it's either TV or mixed mass media. It's not what I ended up wanting to do. I still always wanted to do the Weather Service, but knowing where I was, it was never going to happen.

And the workplace structure was this. [flattens hands] Flat. [laughs] And you couldn't move up unless your boss quit.

So I'm doing this full-time work. It's not what I really wanted to do. It is kind of what I wanted to do, because it is weather but it's not really what I want to do. Because keep in mind, I still always wanted to inform people about the weather, public safety.

And I look back on it now, we were told to do so many things, I never felt like an expert in anything. And I never felt good at my job. I never felt like I was awesome at my job, because we had to do all these different things that the training was, meh, figure it out.

Maggie

But I learned also from that experience of having to go into the office every time severe weather happened: I like to be an observer of it. I like to see it, I don't like to forecast it.

And one of the key decisions that came up when I was making the choice to go back was, yeah, it's farther away from home again, but the trade-off for being happy work— It's not a fair trade. I would rather be farther away from home and happy with what I'm doing, than close to home and not happy with what I'm doing. So that was one of the things that helped me make that decision, too.

And I do have the desire to be out of the office. And that's one of the biggest drives for me, is having that opportunity to get out of the office.

At the time I was considering— Because now that I am eligible to apply for the next forecaster job, I was really torn. Do I stick with this because I can move up in

this? If I go back to my previous occupation, I'm likely going to have to take a pay cut because they're going to want to hire at entry-level.

Xavier

And I think that's probably the biggest, high-touch, first-impact that I was very, very negatively affected by. It was that not only did I get the feeling that there wasn't a ton of work to go around, but looking around, I would see a lot of other people, actual career meteorologists, acting as if they felt very similarly.

So I would with some unfortunate regularity show up to work an overnight shift and find the forecaster that I was to be replacing asleep at his desk in his cubicle. And there was no worse feeling than showing up to work at a job that I potentially could be doing for the rest of my career and taking over the shift from the person who I might become, who was asleep at their desk. [laughs]

And I was concerned, because a lot of these things very much started to fall into these patterns of, this is going to be an awesome project! You're going to be working on this for months! Oh, wait, not really that much work involved actually.

So it was a little bit of a challenge, and I very much kind of feared myself being stuck in a career where I wasn't (a) enjoying my time and (b) wasn't challenged and continually growing and learning, and in an environment of like-minded people.

I mentioned that I was interested in the software thing, because I had enjoyed teaching myself and I felt that I would be much more engaged for the rest of my time if I was focusing on software stuff, and in a different environment with much more like-minded people.

Jacob

But on a daily basis I really wasn't forecasting the weather myself. And so, as far as the job specifically goes, I would say I did not really enjoy it.

But specifically on a day-to-day basis, I didn't really like it because, especially the second time around, it really became a research-driven role. And so you were supposed to follow social media and follow news stories and try to get video and that sort of stuff. And it actually got to the point where, if I had to watch the Weather Channel, I couldn't do it, because I kept thinking about the things that were happening in the background that the producers or whatever were going to have to do. Obviously having a knowledge of weather and being a meteorologist helped. But I wasn't really doing meteorology. I was pretty much just a researcher or a producer. And so it wasn't a horrible job, but I wouldn't say I particularly liked it.

And so that second go-around was really kind of when I really disliked the job,

because all I was doing was research. There were very little meteorological applications.

And then when it came to the few rare occasions where I did actually have to make forecasts, I had no confidence, because I felt like I had no idea what I was doing. And at that company, there were no real education opportunities. There wasn't a person there watching what you were doing and saying, oh, well, think about this, or what about this? Or whatever. It was just, you were on your own.

Courtney

And I felt like, in the long run, teaching, especially in this area, would make more of a difference. I just felt like it would make more of an impact on the world ultimately in the long run.

There was an article that came out recently, I think in Nature, about the emotional side of leaving academia. And this was two weeks ago, three weeks ago. And this article came out, and I read this article and I literally started crying at my desk, because it talked about all of these emotional— The turmoil that I went through trying to make this decision. And I thought I was the only one that felt this way. I didn't realize that other people were feeling this kind of torture at, what are my colleagues going to think of me? Teaching is not science.

I would say, at the end of the day, do what's going to make you happy. Because, in the long run, it doesn't matter [laughs] how many papers you publish if you're miserable. Do what's going to make you happy, because that's kind of the point. I mean, it's a job, but you should be able to enjoy it, too. And I think when I was making this transition, I was really caught up in what other people would think of me for being the leaky pipeline. And that was a huge thing for me. I didn't want people to see me as the leaky pipeline. Who cares? [laughs] You know. I mean, I might not be publishing amazing papers, but I'm still doing work that I know is important and I know is needed, and maybe, in some ways, is more needed and more important than a lot of the research that I would be doing otherwise.

Kim

Eventually we ended up having to change our server system. So the forecasting program that we used to build our own forecasts didn't work on that server system. So we had to scrap it and we were told, we're just going to build a new one. It'll be better. It'll be everything you want it to be, and it'll be ready to go in six months. Well, I quit that job a year and a half ago, and they promised that they would have that program well before I quit, and they still don't have that program. So after that happened, we just pulled up the National Weather Service and used their point forecasts. So it got to the point where the second half of the time I was there, we weren't even doing our own forecasting. We were just reading forecasts from the Weather Service. So now I'm not a meteorologist unless it's summertime. I'm just reading the Weather Service's forecast and calling it a day. So that really started

getting to me. I felt like I wasn't doing what I wanted to do, and so it got really frustrating really quickly. But I'd just sit in this little box, doing these projects, and that was… It only did so much for me before it kind of became apparent that, to me at least, it wasn't ever really going to change. He's like, you don't get recognition at the job you're doing right now, but you're going to get so much at this new job. And that was another thing that I really wanted.
David
And then there were some personal— I would say I got along with everybody, but there were some inter-office politics things that happened. Essentially, I questioned why the senior mets there, the important, the most proper forecasters— I said, why am I not considered a senior met? They said, you haven't put enough time in. I said, well, they're supposed to be the most important ones. Why aren't they handling these high-profile clients? I didn't really get anywhere with that, and so we have that. I mean, I got along with everybody there. I'm not try to sound like I didn't get along with them at all. I did get along with the senior mets, I did learn a lot from them. But sometimes, if it's that important, why aren't you handling it? [laughs]
Need security
Matthew
Generally I'm not very much of a risk taker. But [boss] had conveyed that it was a serious enough situation, and again he said seniority wouldn't necessarily play a role in who was going to get to stay. And so then I was like, well, I'd rather at least have some job and make this move voluntarily than risk being the one let go and saying, now what do I do?
Michael
And so that was one thing where I was like, ok, this offer's almost too good to be true. So I have that on one hand. Then on the other hand, if I say no to [current company], am I going to get, is training going to get cut again in another year or two, depending on how 2016 goes? The election? And so there was the uncertainty. I'm just a really risk-averse person and so it was like, well, nothing is taking away what I already know about the public sector, so I took the job with the intention of kind of keeping my eye on things and seeing if maybe there's a place for me in the future. I want to go to a place that I know is growing. It has stability and will have a good future.

Danny
And so it just made sense. It's great to have a passion, enjoy what you do, but at the end of the day, I need to pay my bills. It's great to have a passion, and I've always believed in the idea that if you love what you do, you'll never work a day in your life, which is exactly what I try to do. But again, at the end of the day, you've got to support yourself and your family. And if you can't do that with your passion, you have to move on.
John
So I'm still doing the same job, still doing the same job. So the economy's really taking a dump at this point, and I was just like, you know what, I'm just going to keep doing this because it's stable. But I was only holding out just so I could hold onto something.
Courtney
I mean, the funding thing definitely played a role. I was concerned about the future of research positions.
David
We were able to start saving some money, but not a lot. And so instead of trying to risk that and who knows where we'd end up, we just moved back home.
Valerie
So my whole time at [company], while I was in [state], I was always looking for a job. Because I knew that my job could go away at any minute.
Need to be physically present with loved ones
Linda
He's an only child. His parents are older. I think we both just wanted to move home eventually. Initially we were looking to move closer to his parents. I think my supervisors at my job were very supportive of me. They knew I wanted to move close to family…
Adam
That's where the two-body problem comes in. I met someone who wound up being military and even at the outset said, I've probably got six months before they move me somewhere else. And I made the decision to move elsewhere with her.

But that's what really caused me to leave meteorology was basically going where someone else needed to be.
Danny
My girlfriend's graduated, and I would be more than happy to follow her to wherever degree takes her. The other half of that is, my girlfriend got her degree in [discipline], and there's a limited number of jobs geographically that she could excel at. Her career options are tied to specific places. And the thought process was, the chances of her getting a job in her field and me getting a job in my field that were in the same place was so incredibly low, it wasn't going to happen. And so having a passion for IT anyway, it just seemed like the right time to go ahead and bite the bullet and start going down that path.
Becky
That was probably one of the hardest decisions of my life. We had been married for two years. We hadn't seen each other for more than three days a week in [laughs] those two years. I could have Tuesday, Wednesday, and Thursday off and go and see him. And then he would have the weekends off and he could come up and see me. So we actually saw each other fairly frequently. But it wasn't sustainable for us. I mean, I don't think it's sustainable for any sane person. I didn't really see a way that it wouldn't happen. Had I gotten a job in [city] or [other city] I think it may have been different. But really we just wanted to be together. It was obviously my decision, but it was a joint decision, too, that it wasn't the life for us to be able to be apart. I think it was more of, I had new goals. We were finally going to be living together.
Courtney
So that's what I ended up doing. I was geographically restricting myself because I wanted to be near my husband. We weren't married yet, but I wanted to be near him. But ultimately, the two factors that the teaching position had was that it would allow me to stay in [state] with my now-husband. Because after three years of long-distance, I couldn't imagine going back to that.
David
She would get off work Friday, drive down to where I lived at the time, which is about an hour and 15 minutes, then spend the weekend. Then I when I got off work

Sunday afternoon, we would drive up to her city. [laughs] And then she would go to work Monday, Tuesday. I would just stay kind of at the apartment waiting for her to get home. And then Tuesday night or Wednesday morning when she went to work, I'd drive back home. And so instead of trying to risk that and who knows where we'd end up, we just moved back home. Closer to my family, closer to her family, working for my parents.
Valerie
So, since my husband's in the military, it was not if, but— Well, actually, it wasn't if or when, it was where. [laughs] So I knew pretty much when he would be leaving. So he actually left nine months before we got married and went down to [state]. So there was a 10 month period where everyone knew I was leaving. So I think that might've contributed to the fact that I wasn't getting a lot of projects, because everyone knew I was kind of not going to be there very long. I think everyone was supportive. They understood my fiancé was in the military, so there wasn't much I could do.
Need to take care of loved ones
Matthew
So I did some initial looking around to see if there were any other jobs open in the area, because by that point my wife was working with [organization] and had gotten a good thing going. And I was like, well, I don't want to look elsewhere necessarily for a meteorology job. It wasn't really an option, because my wife, she had started her career with [organization] and it was a very, very good job for her. I knew she really enjoyed what she was doing. She also has family in the area. And we had just bought our house a year before. So, while we could have moved, it wouldn't have made a lot of sense from a financial standpoint then.
Linda
He's an only child. His parents are older. I think we both just wanted to move home eventually. Initially we were looking to move closer to his parents. And so, really it was more him that I wanted to look for a job first, because I felt like I could do a lot of different things if I wanted to in my hometown or in my husband's hometown. Because I felt like we would probably have more opportunities in his hometown area than in my small town, I was like, whenever you're ready, you can start looking for jobs.
Danny
It's great to have a passion, and I've always believed in the idea that if you love

what you do, you'll never work a day in your life, which is exactly what I try to do. But again, at the end of the day, you've got to support yourself and your family. And if you can't do that with your passion, you have to move on.

John

I hated that job and I loved that job at the same time, because it allowed me to have the life I have now.

So I was like, I got this job, I'm doing it. I carry the insurance. Basically, I was breadwinner without being the full income. I was all the fringe benefits.

I hate that job. I'm doing it because I have to. I'm doing it because it puts food on my table. It feeds my child.

Now keep in mind, my wife tells me she's pregnant again with our second child. [laughs] So I'm just like, well, what am I going to do? I've got to keep my job for insurance, because I don't want to have a thousand-million dollar bill for having a baby without insurance.

But we're all looking to put food on the table. My path was different, to say the least. [laughs] Sometimes you just do what you have to do, especially when you have a family. You sacrifice some things. I'm not trying to be a martyr either, but I knew what I had to do to keep things running for my family.

I'm plateau-ed, I'm plateau-ed, I'm plateau-ed. Kind of just dabbling, this, that, and the other. In 2010, my father-in-law dies. He was an accountant. You can kind of see where I'm going here. [laughs] I've been at this kind of plateau for the longest point. Like, all right, what do we do? We don't have anybody that helps— Keep in mind, he handled all the financial decisions for our family. We didn't really have to think about investments. We didn't have to think about retirement stuff, because he would just do it. Some short amount of time passed. We got to the point where, ok, you want to do something new with your life. Weather is pretty much done. The market is so flat for that, you're not going to find any other weather job without sacrificing, having to move to either [city], [other city], something else. And that's not something either of us wanted to do. So we were just like, why not try accounting? It was kind of just one of those things where, why not? I couldn't even tell you exactly how it arose. It just was like, we have this need. Try it, and see if you like it.

I knew nothing, literally nothing, of accounting when I started. I only tried it because it was something out there that was a need.

Maggie

I'm single. I live alone. I have two dogs and they're both scared to death of storms. And so I worry about them because, since there's nobody else here, if there's

something headed directly for my house, and I have to be at work, there's no one to take care of them and put them in a safe place to avoid any kind of disaster. So that is one of the things that worries me about it. And I just don't like to be stuck in the office when it's going on. I like to be at home.

Becky

I figured, he had moved to [state] for me. It was my turn to make the move for him.

He wasn't going to move back up to be in the city, because he had a good thing going. We didn't really need the money. We didn't really have anything else going. And I think like I said before, he had moved to [state] for me. It was just kind of my turn to suck it up and do the same for him.

It's still a big decision, especially when you're working in the public sector. There's so much that goes into it beyond, oh, we're going to have a baby! Can I take off work? Because if I take off work, there's only 9 other people that can go in, and six of them are already working today. You're directly impacting other people's lives when your kid gets a cold. It's a really tough balance. It's a really tough decision. And when you already consider your co-workers part of your family, I mean, it's just a lot. It's just a lot.

Was—
I wish I could still do it. [laughs]
laughs] Was that anticipated difficulty something that you thought about when you were actively deciding whether or not to stay or leave?
[sighs] When I was a SCEP, I never thought of that.
Mm-hmm.
When I got the internship, yeah, it was kind of in my mind. Like, wow. You have kids and you're doing this and… Yeah, they just never slept at all ever.
[laughs]
And that was really hard. And then you'd get married and you'd start getting pressure from everyone. And it's just tough. [laughs]
[laughs]
I didn't answer your question at all. It's just, it was… Yeah. It was just tough.
So it was something that was in the back of your mind?
Once I got the journey position, it was definitely in my mind.

Need to establish a family

Linda

But in general, moving out of weather wasn't something I looked for originally, but the position came available and it was close to family. It was pretty ideal, because we wanted to start a family. We'd already started trying to start a family and weren't having success yet. So family was a big part of this move.

My supervisors were very supportive as well, because they knew how much family

meant to me.

Becky

But it wasn't sustainable for us. I mean, I don't think it's sustainable for any sane person. We wanted to have kids. We wanted to have normal lives where we had a house and it just… Some things have to give somewhere, and it just happened to be my job.

Oh, it was awful! I loved the office so much. I mean, the staff there was just— I loved each of them like they were my brothers, like they were my dads, sisters, moms. We had a very close bond. We did a really good job, and I learned so much from the people there. I didn't want to move. [laughs] My husband's state was awful. No one thinks they're going to move to that state! So it was just… [sighs] I don't know. Life just kind of takes over.

But it wasn't sustainable for us. I mean, I don't think it's sustainable for any sane person. We wanted to have kids. We wanted to have normal lives where we had a house and it just…

I think it was more of, I had new goals. We were finally going to be living together. I started seeing more of the family goals. It wasn't so much about what I could do with my job. It was more about what we could do as a family. It's hard to be a female and do everything. So I think I went more towards the familial part of it than I did towards the job part of it.

And I think part of the reason I liked the office so much is because it was more familial. We had such a good time together and we learned so much together that I wanted to continue that experience even if it wasn't within meteorology, because I was in a new place. So I was looking for— I had my surrogate family when I was in [city] and I wanted to have my own family when I moved elsewhere.

If my heart wasn't there, I had to find the place where I could be me and be with my family and be everything that I wanted to be.

David

We have my wife and I trying to plan life out together. How are we going to have a family if one of us is always missing for most hours? [laughs] So we're trying to figure things out like that.

I would say mostly it was the schedule, because I could've even dealt with that. I had been dealing with that, so I could've dealt with that. I just wanted a little bit of flexibility in the schedule. So that's the whole spring and even in the early summer where I felt we could've adjusted things that could make things more amicable. And they'd swear they couldn't do that at the time.

And so then I told them, I really enjoy working here. This is the best job ever, but we're trying to build our future, and here's my two weeks.

I had kind of gone from not knowing whether I could forecast weather, to knowing I could forecast weather, to knowing I could forecast the weather on a pretty high or public level. So where I didn't have anything else really to prove. So I felt, ok, to get all of the rest of my life, I was ok with walking away.

Sometimes we talk about, could it have worked? It could have, but when you're thinking about trying to plan your future, you want to go for what you think will work the best, not what could work. Our relationship is one that we could've made just about anything work. But did we want to just make it work? Or did we want it to be what we wanted?

I've also matured to the point where, when I walked away, I realized life is more than just your job. If I was still straight out of college and I didn't have a wife, I'd have stayed at that job for forever. But once you find somebody and want to start settling down, you want to start a family and being off on holidays so your parents can see your kid… Once you start thinking it's kind of like that, it makes the walking away a little bit easier.

Need to take a good opportunity

Linda

And then with my parents. They have their own business and their receptionist was basically failing. [laughs] And my mom offered me a position. Come back and work at the office. She was like, why not offer it to one of my children, because I believe in them and I know this is an important position. So she offered it to me, and when she did that, I was like, yes, I'm interested…"

But in general, moving out of weather wasn't something I looked for originally, but the position came available and it was close to family. It was pretty ideal, because we wanted to start a family.

Michael

But gosh, about six months ago, [current company] called me out of the blue. They had a recruiter phone me. And he basically said, you have a really interesting skill set dealing with the government and a strong background, and we want to hire you. So I was like, ok! I don't think I'm interested. And they did what the private sector does, and they basically let me write my own salary, pick what office I wanted to go to, plus paid for all my student loans and everything like that. So, they gave me a really sweet gig.

And so that was one thing where I was like, ok, this offer's almost too good to be true.

Danny
And then last July, our systems administrator left, and I took the opportunity to move into her position because it offered more opportunity to me in the area. As a contractor, there's little to no room for promotion. You kind of get stuck where you're at. And I was getting tired of a lot of the politics that were going on within the weather side of things. So I took the opportunity to move into IT at the same facility. I gave the meteorology thing a chance. It just wasn't moving. It didn't have the career prospects I was looking for, whereas IT, at least in this area, really does.
Xavier
And I kind of coincidentally managed to find a connection who I had lost touch with, who was starting a software company back here in [city], which is where I am now. I reached out to him and kind of talked him through my current situation. And in a very different context, he had felt a very similar pull. He was working in finance and there were a lot of parallels between our primary motivations for exiting, and so I think he took a little bit of sympathy with my cause.
Courtney
And so all of a sudden, at about a year after my defense, I guess I had just been in the area long enough that all of a sudden, I had three potential jobs. I had an offer of a post-doc at [university]. I was informally discussing a position at [laboratory]. And the executive director of [current educational organization] offered me a job as a full-time science educator. But ultimately, the two factors that the teaching position had was that it would allow me to stay in [state] with my now-husband. Because after three years of long-distance, I couldn't imagine going back to that. And I felt like, in the long run, teaching, especially in this area, would make more of a difference. I just felt like it would make more of an impact on the world ultimately in the long run.
Kim
And so he pestered me for at least a year to quit and join his company before I finally did. I wasn't really optimistic. I kind of was just so frustrated with the job that I just went, ok, fine. So I touched my resume up, threw it at the contracting company, and I got a job offer about two months after that.
David
And then my parents have their own business that they were trying to expand. And so they came to us with an offer and said, come home, work for us. You could have a family, you'll be closer to family. We'll give you more normal hours. You guys can have evenings and weekends and do whatever families can do. And so instead of trying to risk that and who knows where we'd end up, we just

moved back home. Closer to my family, closer to her family, working for my parents.
Valerie
But my friend sent me these two positions, and I was like, well, let's apply! And then all of a sudden these applications led to phone interviews. And then all of a sudden they led to in-person interviews. [laughs] And I was like, holy crap, I'm going to an in-person interview at [company]. [Company] is, when I was there, it was on the Forbes list of the 50 or 100 best places to work. So it's known nationally as a very good place to work. And I didn't want to turn down an opportunity to work at [company]. I'm still glad that I made that decision.
Lack of hiring
Matthew
I had thought about trying to go back to my previous employer. But they didn't have any openings at the time…
Linda
And what I was doing my job searching, I don't think I necessarily looked for something that was weather-specific. I know they're also very hard to come by. There's not too many of those that come up.
Adam
It didn't seem like anyone was actually hiring at the time, which didn't help. So timing was a factor.
Michael
It was the fact that so many people who were really smart and really talented and really qualified could not find jobs, period.
Danny
[sighs] I almost feel guilty because I wasted— I look at it almost like I wasted three-and-a-half years of my life. I got an education I'm not going to use because I'm not going to do meteorology. There no job market for it. It was just a really, really tough job market at the time. And that's what was really frustrating is, I wasn't hearing anything back. I wasn't getting interviews. I wasn't getting rejection letters. It was just radio silence. I'd send resumes out and fill out applications and they would just disappear. The public sector meteorologist market is so closed, it's not even funny.

It's a failure of the weather enterprise. It really is the failure of the public sector. They've set themselves up… Well, I guess they've kind of misled the public, the weather weenies of the public, that, oh, if you go and get a meteorology degree, you can come work for us. And that is just not the case.
John
Weather is pretty much done. The market is so flat for that, you're not going to find any other weather job without sacrificing, having to move to either [city], [other city], something else.
Becky
I know that when I was applying for journey positions, there was a [city] job in there. I applied at [other city]. There were a couple places that definitely I was hoping to be picked up, but I wasn't. And that's one of the hardest things with the public sector jobs. They're open and then they're not. And then there's a hiring freeze and then there's not. And there's just no way to have any stability. And had a job been open at [city] or [other city], it may have made a difference. But there weren't any jobs open and you can't just magically make one open up.
Jacob
So I did continue to apply for jobs, but admittedly, I wasn't applying for many, because frankly, I didn't see that many opportunities come across my way.
Courtney
And so that and the whole funding thing was just— Because right at the time I graduated it was just like, there's no funding for anybody to do anything.
Kim
Because at the time there wasn't anything out there. The Weather Service wasn't hiring. The only other company in the area was that other one. Again, I was really hoping that the Weather Service would open up. But that was when the government kept getting shut down. They weren't hiring. Everything was on a freeze.
Overall lack of jobs
Adam
It's a small field. It's challenging trying to find employment. I think any field as small as meteorology tends to be, you would have the same problem. But there are other fields like generic software development, not targeted

to any one area. Teaching, the medical profession: anything like that that is pretty much available anywhere. You would have less of a problem staying in your field. Meteorology is so niche that it's just difficult to stay in it I think.

Michael

The opportunities that used to be there are not there, and you have a lot of people who have a lot of experience who have been let go at companies. It's not as easy as it used to be.

Jacob

At that point I'd kind of known that a career in meteorology was going to be a lot harder to get than I thought it was. And so, I think at that time I was maybe realizing that— Certainly not to give up on meteorology, but that I maybe needed to start considering other options, because all my life, I'd wanted to be a meteorologist, and now here I was. I had my chance and now, maybe there's not going to be another opportunity, or certainly not an opportunity in the near future.

On top of that, every year, they come out with these lists of the most in-demand professions or the hottest jobs or that sort of stuff. And I remember meteorology being on that list a couple times when I was in college. And obviously, at that point, I had already made my decision and wasn't going to be influenced by it. But I remember specifically seeing that demand for meteorologists is going to be high, and it almost made it seem like anyone that wanted to be a meteorologist would be able to find a job. And that certainly is far from the truth. And so that's always been kind of a confusing thing to me, too. That anytime I would read about meteorology as a career, they would make it seem like it's just this hot field and that there are going to be so many opportunities and you're going to get paid well. And now that I'm trying to pursue that, it doesn't seem like the truth.

It's really tough to look at someone who's a nurse or a programmer or an engineer: these truly in-demand careers where they can pretty much get a job wherever they want. It's really tough to look at them and see those people with so many opportunities, and then see me with so few. It's tough.

I don't think meteorology has as many opportunities as maybe we're led to believe.

So it just kind of became, before college, I thought there were X number of jobs in meteorology available. And then after college, I realized it was Y number of jobs, which is significantly smaller than X. And then I kind of just continued to whittle away: Well, I don't want to do that. I can't do that. And that's not going to happen. So the amount of available jobs has significantly diminished.

Kim

And especially the two local places here, they just seem like they know that you

don't have any other jobs to go to.
But, I mean, I feel like a lot of people are going in for this very specific degree and then, either not getting a job…

In college everything always seemed so, you'll graduate and get… Meteorology is a growing market! You'll have your pick of research!. Or a lot of the girls, and especially some guys that I was in college with, were dead set on broadcast. But everybody seemed to have, like, oh, there's tons of research jobs, and the National Weather Service is this huge godlike thing. And it always just seemed… Because you don't look for jobs when you're in your second and third year of college, and so it always was just kind of implied that the jobs would be there once we graduated. But I didn't really start looking until I was about done, and that's when I discovered there really weren't that many.

David

And especially, too, it seems like in the private sector, those acquisitions by bigger hands and stuff, it's getting smaller, and there's not always those opportunities. You yourself heard about the dissolving of [private weather company], and I think [other private weather company] was just before that. There's not as many of those spots to go around as there used to be.

Prohibitive competition

Adam

You're probably well aware of at least some of the considerations with meteorology-related jobs in this area. As I understand it, you have people with a Ph.D. applying for entry-level positions.

Courtney

And I had absolutely no illusions with the way the funding is going. I can't see that there's any way I could get back into the field, now that I've had a couple years of no publications. And I knew that going into it. But partially, I think why the job choice was so excruciating is because I felt like I had to make this choice right now. Like, jump off the train or not. And once you jump off, you can't get back on. And that was where I made that decision from, and it was horrible. It was really, really horrible.

Kim

And especially the two local places here, they just seem like they know that you don't have any other jobs to go to. So they came to people who are aspiring, people that just got out of college and they've got the degree that they want, and they just kind of chew them up. That's what I've really observed.

David

Most of the time, you're out, next man in. Especially with graduation. If you leave

right before graduation time, they'll post it quickly, and it'll have all those new incoming resumes. [sighs] I think the only thing maybe would be, because there is always that kind of next-person up mentality. I think sometimes they let the way it is lag, but on the employees. But I think— And I know it's my first job out of college, but I wasn't exactly working at Starbucks. So should I have had to have gotten another job to pay the bills in [state]? Probably not. If I put in five years with a company, but I think my pay only went up, I want to say, 10% in five years? And I'm not answering the phones. I'm handling one of your higher end clients. So sometimes I think because of that, there's always the, well, if you don't like it, you can leave, and if you leave, then I can get someone in who's fresh out of the box and start them back in that low number. [laughs]
Valerie
Meteorology is so competitive and you have to really be passionate about it, and I just don't think I have that passion.
Insufficient educational background
Matthew
Even though I was the most senior member of the junior people that worked there, I didn't have a master's degree. And not once, but twice, [boss] had come around and had wanted to take note of how long we had been at [company] and what our highest level of education was. So that concerned me, that I thought, well, I might be one of the first ones let go, because I didn't have a master's degree.
Danny
I was incredibly ill-prepared to go into the job market. And I don't blame my professors for that or any of my friends or anything. I blame myself for that. I should've done more research in my junior year going into my senior year to determine that, in order to even have a chance at having a forecasting job, I had to have a master's. That's just the climate that they progressed into.
Jacob
Because when I look at the American Meteorological Society or a bunch of other job boards, there's a lot of stuff up there for people with master's degrees or doctorate degrees or post-doctorate. There are high quality jobs out there. In the National Weather Service case, I'm apparently not good enough to be a National Weather Service employee. I've been told numerous times that you essentially have to have a master's degree to even be considered for the Weather Service, which I don't have.
Kim

But if I was finding things, a lot of them required either master's degrees or very specific and high amounts of real-world experience in forecasting and what have you. And so there were a couple, I can't even remember what they were. I think I threw my resume at a couple things here and there. But nothing ever stuck.

Insufficient skill set

Matthew

There wasn't really much. For one, meteorology had become so heavily dependent upon computer programming. I would consider myself an intermediate person with regard to HTML. I tried to proactively teach myself Java and Flash. But I just never really had a knack for it. So I knew that was going to be limiting my abilities to be able to get a job with, say, a research organization or even with a private company. So I knew it was just going to end up being really, really hard for me to be able to stay in my area with basically a rather limited skill set in terms of what I found were my interests.

Were there any other types of jobs in meteorology that you thought might be available, or did the programming seem to shut them off?
The programming basically kind of shut them off.

Adam

The jobs that I was seeing tended to involve clustered systems. This is again one of those things where early experiences shape what happens down the road. Because I worked with [research topic description], I never had the opportunity to use the supercomputer and get experience doing things like MPI development for multi-processor environments and whatnot. And so now, even if I wanted to jump into a job at [local research organization], a lot of them require MPI experience and various other things, and you can't really gain experience in those things on your own. You need to have access to a supercomputer or something along those lines. So, there are things earlier on that sort of made it difficult to try to get back into meteorology as well.

Danny

And it was a two-pronged thought process that I had gone through. I had been considering it for a while, simply because I knew I needed to diversify my skill set. Being just a meteorologist wasn't good enough, and that had become apparent by not getting anything back from any of my job applications.

Meteorology is one of those sciences you have to stay on top of all the time, because it's always moving forward.

Jacob

And now that I look back on it, I think I thought I was 100 percent passionate about meteorology, but I don't think I am. Either I lost that passion, or the passion was a

little misguided. I don't know exactly how to say what I'm trying to say, but… Because I feel like if I was truly passionate for meteorology, I would find a way to get a job or I'd be willing to re-read all my textbooks. [laughs]

Kim

But if I was finding things, a lot of them required either master's degrees or very specific and high amounts of real-world experience in forecasting and what have you. And so there were a couple, I can't even remember what they were. I think I threw my resume at a couple things here and there. But nothing ever stuck.

And once you've been out of the game for a while, I know sometimes folks go, well, they don't know about this new thing that happened, or they're rusty. And forecasting isn't exactly and easy or low-stress thing, and it's got a high cost if you really screw up.

Valerie

I also kind of had the feeling like, oh, I've been out of it too long, especially operational meteorology. Like, you know, [private weather company] and the Weather Service are operational. So what was I going to say? Like, oh yeah, back in 2008, I forecasted weather over the ocean. But I didn't feel like that was very plausible, at least operationally speaking anyway.

Meteorology is so competitive and you have to really be passionate about it, and I just don't think I have that passion.

And he was like, hey, we're hiring. And I was like, I can't go back to [organization]. You guys don't need my skills. [laughs] They needed more programmers I think.

Lack of geographically-available jobs

Matthew

So I did some initial looking around to see if there were any other jobs open in the area, because by that point my wife was working with [organization] and had gotten a good thing going. And I was like, well, I don't want to look elsewhere necessarily for a meteorology job.

Ok. And so it sounds like moving was not something that was really—
It wasn't really an option because my wife, she had started her career with [organization] and it was a very, very good job for her. I knew she really enjoyed what she was doing. She also has family in the area, and we had just bought our house a year before. So, while we could have moved, it wouldn't have made a lot of sense financially, from a financial standpoint then.

Linda

But it is harder with meteorology to move around I feel like, because the jobs just aren't everywhere that you want to be. So it does make things more difficult.

It started becoming more and more obvious that I wasn't going to be able to live real close to home if I wanted to. Especially where I lived. Maybe if I was from a big city that would've been fine. But not from real small-town U.S.A. was I going to find a job there.

Adam

And I had originally worked out a deal where I could work remotely. And after a few months, that ceased to be a viable option. The company had made decisions that they would prefer not to have people work remotely.

Did you look for other meteorology jobs?
I had, but at the time, I was in [state], specifically the [city] area. And there really wasn't anything to be had.

Now, there should have been a lot of meteorology-related stuff in that general area. But where we were living made it difficult. Because anything in [city] or— Let's say [private weather company] was out there, but they were out in [suburb], which was prohibitively far away for me to have really considered.

But there are other fields like generic software development, not targeted to any one area, Teaching, the medical profession: anything like that is pretty much available anywhere. You would have less of a problem staying in your field.

But that's what really caused me to leave meteorology was basically going where someone else needed to be, which limited the market as far as what jobs were available.

If the job market had allowed me to stay in, I would have willingly. In my case, it didn't though.

Danny

The other half of that is, my girlfriend got her degree in [discipline], and there's a limited number of jobs geographically that she could excel at. Her career options were tied to specific places. And the thought process was, the chances of her getting a job in her field, and me getting a job in my field, that were in the same place was so incredibly low, it wasn't going to happen. And so having a passion for IT anyway, it just seemed like the right time to go ahead and bite the bullet and start going down that path.

It wasn't a problem finding her work. It was a problem finding me another weather job somewhere that she could be in [science] still.

John

I was telling myself, well, I can't drag my wife out to the middle of nowhere, because (a) she's not going to want to go, and (b) that's just not fair. Because the only place I would've been able to start is the small— I shouldn't say small regions, just the low populous regions. Your Provos, your Glendives, your nowhere places. So if I hadn't been in a relationship, I would've earnestly tried that.

Weather is pretty much done. The market is so flat for that, you're not going to find any other weather job without sacrificing, having to move to either [city], [other city], something else. And that's not something either of us wanted to do.

If life was a vacuum, would I still be doing it today? I can't say for sure. My guess would be yes, because I would've moved somewhere else. If you look back on everything, it's dominoes that all fall into place. If that first one never fell, where would I have been? Would I have moved on? Would we have amicably split? What would we have done? Would I have gone out west? Don't know. But because all of these things happened in a row, here we are.

Becky

I loved the job so much, I stayed in [state] for two years while he was living in [other state]. I couldn't bring myself to move to [other state] yet, because the closest office was [city] or [other city] and they were both two hours away. And that was completely off the table. There's no way I was commuting two hours to and from work.

But one of the hardest parts of the job was knowing he was living elsewhere and I didn't have the option to really continue my job there.

I always thought, well, maybe I'm going to get a job in a big city. You have your M.B.A., we can be in a big city together. And it just never panned out.

When he got the offer for [company], I kind of felt a little more stuck in my place, that I couldn't just move further away. I mean, it was only a three-and-a-half hour drive, it wasn't that big of a deal. Had it been a plane trip or something like that, I think it would've been different.

But again, I'm kind of in a weird location where there isn't a whole lot for me to do here, and that's always been the limiting factor.

Courtney

So my plan was, well, I can move to [state] and get a post-doc at [research organization], because that's what everybody does. And I will do that post-doc for a couple years, and then we will move somewhere and I will find my dream faculty job and they will love me so much they will give me tenure immediately. [laughs] A dream.

So that's what I ended up doing. I was geographically restricting myself because I wanted to be near my husband. We weren't married yet, but I wanted to be near him. And there's just not a whole lot of options in [state]. [laughs]

And so all of a sudden, at about a year after my defense, I guess I had just been in the area long enough that all of a sudden, I had three potential jobs. I had an offer of a post-doc at [university]. I was informally discussing a position at [laboratory]. And the executive director of [current educational organization] offered me a job as a full-time science educator. But ultimately, the two factors that the teaching position had was that it would allow me to stay in [state] with my now-husband. Because after three years of long-distance, I couldn't imagine going back to that.

Kim

And hunting around locally in my state— I did not have money to move. I didn't have the means to move very far. So I was just looking around where I could.

And we got paid what was comparable to TV broadcast pay. So none of us made enough money to just go, well, I'm going to move to California where this weather company will hire me.

I think I did eventually. I think somewhere in the middle of God-knows-where, Nevada had an opening one time. And I just threw my application at it and never heard anything back. But I was just like, anything, please! But at that point it was, I didn't really have the money to move across country.

But nothing local was really available.

Valerie

It was, there were no meteorology jobs. The only meteorology jobs might be at one of the news stations or the Weather Service office, which is actually in [other city]. [sighs] There's no private weather companies.

I did look. There is [private weather company] in [city]. There is the Weather Service office in [other city]. Just looking at— Because we had to make a decision where to move. And looking at where we were wanting to live, those were not options. So I did look.

And were there any private companies besides [private weather company] or—
I think it's [private weather company].
Ok.
That's the only one.
Ok.
There might be something in [adjacent state], but again, it was just inaccessible.

Ok.
There's nothing in [city].

I will say, though, [private weather company] had a really interesting position that I talked to them about. [job details] But they were very interested in me. I was very interested in the position. And we talked about it, and you could tell they were like, well, I was in [state], but they're in [adjacent state]. So I was like, can I work from home? They're like, no, you really can't do this from home. And they were like, what if you just came to [state] Monday through Friday and then went home on the weekends? [laughs] I was like, oh, a seven-and-a-half hour drive. [laughs] And I have to go through [city] each way. No thanks. And also I had to be away from my husband for most of the week. I'm like, well, what's the point?

Lack of appealing jobs

Michael

And that was another big part of why I left, is that I really— So the organization I thought I knew about really did not exist anymore. And these types of practices had really started to show their ugly heads.

And then the public sector is always kind of where I wanted to be, but then getting into [organization], I realized that in those just couple of years that I was gone and in grad school, removed me from how things were going. Things have really rapidly changed, and I don't think for the better.

But you're in the belly of the public sector bureaucratic beast. There was just so much red tape. And you really got to see how dysfunctional and how kind of away from meteorology— I don't know how to say this. When I was in [city], we were doing pure weather. I was doing pure weather. There was some bureaucratic-ness, but it really kept itself out of the forecasters' way. So you just kind of went to work, did what you were supposed to do, and that was that. By 2013, things were very different. The sequester had really taken its toll on morale. Training was butchered. And they were trying to bring it back, but it was a different organization from when I left it.

But then, when the government is making you take forced overtime and they're not replacing any staff that leaves, leaving people high and dry in terms of, well, where is the future going? It destroys the culture. And so that was the other big thing where I'm just like, I don't know if I want to be part of this now, because the public sector is just going through too many growing pains.

Danny

As a contractor, there's little to no room for promotion. You kind of get stuck where you're at.

I gave the meteorology thing a chance. It just wasn't moving. It didn't have the

career prospects I was looking for…

Adam

There's an interesting position of sorts that's starting to become more prevalent in university research groups, and that is sort of the in-house software developer of sorts for research groups. There aren't many of them out there, though, is part of the problem.

Xavier

So I did a little bit of research into private sector meteorology and I reached out to a friend who was, and possibly still is, working for a shipping company, and based on his description and the structure of the work, it didn't really sound like that big of a change. There was a lot of shift work. He found himself kind of working on side projects primarily and doing the forecasts as a secondary task, because it was very trivial.

And so when I ended up quitting, I ended up kind of sharing this similar story and [laughs] was met with a mixed bag of, we totally agree. A lot of what you're saying is valid and true. Unfortunately, a lot of these things can't really be changed because of the way that the workers' unions are established and the way that the government has structured how we get funding and all of these things. And it was kind of like, yeah, I know. That's why I'm leaving.

I just really want to reiterate— And I don't know if I kind of impressed this enough upon you while we were talking about it. The way that the public sector structures its shift work and its scheduling and its over-formality of everything is so detrimental to employee happiness. And this is not just me speaking. This is me speaking after conversing with lots and lots of people who feel very similarly, who are still employed by the Weather Service. And if they ever want to improve the way that the Weather Service works— And unfortunately, as a government agency, this is very difficult to do. But if they ever want to improve it, those are the things that need to change.

The reason the public sector is in the state that it is in is because it's so unpleasant for people like me to be in it. And the people like me who are finding this place very unpleasant are the people who should be involved in getting it changed, to encourage much more of that type of mindset. So it was like, the irony of the reason. The reason that I'm leaving is because there aren't enough people who are motivated enough like myself to change it.

Courtney

I'm not really interested in the post-doc aspect of jumping from place to place every two to three years. And that's a part that always was really not appealing for me.

At the rate things are going, I just don't really want to work full-time for the college here in town because it's a complete disaster and they would probably go under in a couple years anyway. [laughs]

Jacob

Because when I look at the American Meteorological Society or a bunch of other job boards, there's a lot of stuff up there for people with master's degrees or doctorate degrees or post-doctorate. There are high quality jobs out there. I think there's kind of a disconnect. I think there's entry-level, basic-level jobs for meteorologists and then there's the higher stuff. I don't know how much middle ground there is.

Kim

And there were a couple little local things that would show up, but it didn't really look great.

The only thing I guess I would add was that there was one company that kept coming up in my searches while I was looking for weather jobs. It was called [other company]. Quite a few of my co-students in my program worked there. And I asked around a little bit, and all the feedback I got was not good. It was a lot of rolling shifts, constant restructuring of the company, which would make you lose promotions and raises and all of that. So, the one job that kept coming up, I just kept hearing these awful horror stories about it. [laughs] Like, oh, well that's helpful!

There was only that other one company and after working at [company], the horror stories that I heard about [other company], I'm like, ok, those all seem legit. Because I didn't really fully believe them until I lived a company similar in set-up to it. And once I'd been at [company] for a bit, some students at [university] who graduated a year after me started getting jobs there. And they all were saying the exact same things that I'd heard. And so I'm like, no, we're not going there.

But I feel like a lot of people are going in for this very specific degree, and then either not getting a job or finding out that the jobs out there might not be worth getting.

And especially the two local places here, they just seem like they know that you don't have any other jobs to go to. So they came to people who are aspiring, people that just got out of college and they've got the degree that they want, and they just kind of chew them up. That's what I've really observed.

David

[sighs] I think the only thing maybe would be, because there is always that kind of

next-person up mentality. I think sometimes they let the way it is lag, but on the employees. But I think— And I know it's my first job out of college, but I wasn't exactly working at Starbucks. So should I have had to have gotten another job to pay the bills in [state]? Probably not. If I put in five years with a company, but I think my pay only went up, I want to say, 10% in five years? And I'm not answering the phones. I'm handling one of your higher end clients. So sometimes I think because of that, there's always the, well, if you don't like it, you can leave, and if you leave, then I can get someone in who's fresh out of the box and start them back in that low number. [laughs]
Valerie
If I could find something that blends training and development with weather, fantastic. But I'm pretty sure [organization] is the only real opportunity for that.
Lack of secure jobs
Matthew
In the spring of 2013, we got an announcement from [boss] that there were going to be some pretty significant funding cuts to the budget. And he said that, more than likely, there would be at least one person that would have to be let go. Now, he was like, I'm not going to say who it's going to be, but we're not necessarily going to be taking seniority into account when we determine who is going to be let go. […] So whenever they had said that the funding was going to be cut and that at least one of us would be let go, and that it wouldn't be necessarily based on seniority, I started kind of putting the pieces together and thought about that. I was like, well, I'm the only one that doesn't have a master's degree. Even though I was the most senior member of the junior people that worked there, I didn't have a master's degree. And not once, but twice, [boss] had come around and had wanted to take note of how long we had been at [company] and what our highest level of education was. So that concerned me, that I thought, well, I might be one of the first ones let go, because I didn't have a master's degree. The other indication, too, was that they were starting to figure out who was going to work on what projects for the next fiscal year, and they hadn't assigned me to a project yet. Another reason that I thought that I might be the one let go was that, I think by that time, I was the only one who wasn't a lead on any research papers. So I kind of like to say that, while I wasn't forced out necessarily, all indications that I had at the time were going to be that I was going to be the one let go, because I didn't have the advanced degree.
Michael
And so that was one thing where I was like, ok, this offer's almost too good to be

true. So I have that on one hand. Then on the other hand, if I say no to [current company], am I going to get, is training going to get cut again in another year or two, depending on how 2016 goes? The election? And so there was the uncertainty. I'm just a really risk-averse person and so it was like, well, nothing is taking away what I already know about the public sector, so I took the job with the intention of kind of keeping my eye on things and seeing if maybe there's a place for me in the future.
Adam
Especially stuff in this area tends to be sort of timed. I'm trying to think of how to put that one. Timed contracts, a year or two. And then you're back in a position of, am I going to have a job in two years?
John
Now on the job side of things, the company changed hands. In the next three years, it changes hands three times. Corporate takeovers. So in my mind, I'm waiting for the ax to drop at any point. Newspaper business: Every time we turn around, our revenues… As much as I could gather, they were six figures when I started for newspapers, and it dwindled, it just dwindled, dwindled, dwindled… I didn't leave because I wanted to. I left because I had to. I left because they were going to kill me off anyway. But I didn't leave weather because I wanted to.
Courtney
And so that and the whole funding thing was just— Because right at the time I graduated it was just like, there's no funding for anybody to do anything. And both of those experiences were just kind of a real turn-off. I lived in fear that he was going to cut me off or send me an email and say, ok, you got one more month, or something like that.
Valerie
They had lost funding for my position, so I didn't really have a choice. I just had to start looking for a job. The job security was always a bit tenuous. So my whole time at my organization, I was always looking for a job, because I knew that my job could go away at any minute.
Lack of well-paying jobs
Matthew
I had thought about trying to go back to my previous employer. But they didn't have any openings at the time, and they had said that even if they would've had an

opening, that I would've had to take a significant pay cut, because in their mind, it was going to be an entry-level job, which would've put me back basically to what I was making back in 2005. And so I didn't really want to do that. [laughs]
Adam
Software development, compensation-wise, is, as I have found, much more lucrative than meteorology jobs. So my desire to get back into meteorology, while it is somewhat strong, isn't strong enough to take a major pay cut to do it, if that makes sense.
Jacob
On top of that, every year, they come out with these lists of the most in-demand professions or the hottest jobs or that sort of stuff. And I remember meteorology being on that list a couple times when I was in college. And obviously, at that point, I had already made my decision and wasn't going to be influenced by it. But I remember specifically seeing that demand for meteorologists is going to be high, and it almost made it seem like anyone that wanted to be a meteorologist would be able to find a job. And that certainly is far from the truth. And so that's always been kind of a confusing thing to me, too. That anytime I would read about meteorology as a career, they would make it seem like it's just this hot field and that there are going to be so many opportunities and you're going to get paid well. And now that I'm trying to pursue that, it doesn't seem like the truth. Could I get a, a small market TV job? Maybe I could. I would like to think I could. But that would probably also at this point mean a significant pay cut from an already relatively low salary. I'm not willing and, frankly, I don't think I could afford to make.
Lack of fit with life demands
Becky
And he was worried about me living about myself and working midnight shifts. And that sounds kind of stupid, but being a single woman, that was— Or not single, but just being a female on her own, working midnight shifts, when you're coming home at 8 a.m. by yourself. It can be a little bit fear-inducing I want to say. Not that I couldn't take care of myself, but you just have a different mindset. And I'd be out on the roads when I'm tired and that concerned him because he wasn't there if something happened. And it was more of compilation of little things. I had my gall bladder out. He had to take a week off of work because he wasn't there! Just the little things added up and it was not sustainable. My parents were very… I mean, they didn't care where I was, but at the same time, they always thought I was crazy that my husband and I didn't live together. They thought that was the weirdest thing ever. So I think there was a little bit of pressure there, too, that it was non-traditional. And non-traditional is fine, but for me, it

wasn't sustainable.

It's tough. It's tough to have a family and work shift work. It's just tough, no matter how you look at it. I see friends that are still in the public sector that have little kids and are dealing with daycare and the hoops that they have to go through to keep their jobs. I just don't think that was for me. As much as I loved the job, it's so incredibly overwhelming to have to juggle all of that. Mad props for the people that can do it, but I, it just… It was overwhelming to me, the amount of stuff that they have to go through. Especially when you don't have family nearby. When you're already moving to a new location and you don't have the support system there, it's hard to do. Had we had more support, maybe. Just people close by that if something happened, you could do something about it. But I don't think we could've done it otherwise. I don't think I would've wanted to do it otherwise.

APPENDIX F

Participant responses to questions about whether or not their exits were avoidable

Matthew	
Yes	**Ok. And what if your contact had not brought forth the job?** Then I probably would've tried to take my chances with staying on at my organization. If I knew that my position were a little more secure. Of course, our boss,, he has a… [laughs] We liked to say that he didn't really have a filter. Had he not basically said that the situation was as uncertain as he had, then I might not have really thought abut leaving.
No	Though [chuckles] from what I understand in hindsight, with keeping in touch with some of the people, I probably would've looked to have left anyway. The nature of the organization had kind of changed to where it wasn't as fun as it had been a few years previously.
Michael	
Yes	More stability in the future would have definitely changed things.
Adam	
Yes	If the job market had allowed me to stay in, I would have willingly.
No	In my case, it didn't though.
Danny	
No	If I hadn't been going to grad school anyway, I probably would've found a different way out of it.
John	
Yes	If life was a vacuum, would I still be doing it today? I can't say for sure. My guess would be yes, because I would've moved somewhere else. If you look back on everything, it's dominoes that all fall into place. If that first one never fell, where would I have been? Would I have moved on? Would we have amicably split? What would we have done? Would I have gone out west? Don't know.
No	But because all of these things happened in a row, here we are.
Maggie	

No	I think it was going to happen.
Jacob	
Yes	If they had reduced my workload significantly, I probably would've been fine. Because what happened is, after I put in my notice—I had kind of explained why I put in my notice—they did reduce my workload. And after that, it wasn't as bad. I still didn't want to work there, but it wasn't as bad. If they had reduced my workload, it might have been ok, but... In that position, or in any other position, if I had a mentor that actually was there to teach me, that would've helped a lot.
No	If they had reduced my workload, it might have been ok, but still, I was still doing a mundane, almost a factory-like task. But in that specific position, I don't know if there's anything that really could've been done to keep me. It was the actual work, that mundane-ness. I don't think I ever would've adjusted to it.
Becky	
Yes	And had a job been open at [city] or [other city], it may have made a difference.
No	But there weren't any jobs open and you can't just magically make one open up. I said before, the two hour commute just wasn't going to happen. I didn't really see a way that it wouldn't happen. It's tough. It's tough to have a family and work shift work. It's just tough, no matter how you look at it. I see friends that are still in the public sector that have little kids and are dealing with daycare and the hoops that they have to go through to keep their jobs. I just don't think that was for me. As much as I loved the job, it's so incredibly overwhelming to have to juggle all of that. Mad props for the people that can do it, but it just… It was overwhelming to me, the amount of stuff that they have to go through. Especially when you don't have family nearby. When you're already moving to a new location and you don't have the support system there, it's hard to do. Had we had more support, maybe. Just people close by that if something happened, you could do something about it. But I don't think we could've done it otherwise. I don't think I would've wanted to do it otherwise. I couldn't do all of that. I don't think I could've given my 100 percent to

	every aspect of that. Once my kids get in school, I'm going to be able to dedicate myself to something like that again. But I just… I didn't want to do all of it all of the time.
Courtney	
Yes	The way I thought things were kind of going to work out differently is that I kind of expected— For some of the other students in my research group, my advisor kind of introduced them around and helped them make connections that he anticipated would help them find a job. And he never really did that for me. And I always kind of wondered, if he had… I mean, imagine yourself at AGU, and all the big-name people, they don't really talk to grad students [laughs] unless they're specifically introduced. I always kind of wondered if maybe things would've worked out differently if he had kind of bothered to do that a little more.
No	And thinking back to when you were making that decision to take this job, would there have been anything at that time that you can think of that would have changed your decision? No. [sighs]
Kim	
Yes	Things at my company were going to change a lot. [laughs] So unless some radical change happened where they built the forecasting tools, shifted around schedules a little bit so I could actually have some kind of social interaction here and there… That probably would've prolonged it.
No	But knowing where they are now, I don't think it would've fully prevented it. It would've happened eventually.
David	
Yes	I think if they would've been willing to work with me on the schedule some. If I was still straight out of college and I didn't have a wife, I'd have stayed at that job forever.
No	But once you find somebody and want to start settling down, you want to start a family and being off on holidays so your parents can see your kid… Once you start thinking it's kind of like that, it makes the walking away a little bit easier.

"Yes" indicates that the participant felt their exit was avoidable, while "No" indicates that the participant felt their exit was unavoidable.

APPENDIX G

Participant responses to questions about whether or not their exits were typical

Linda	
Yes	It's a leap of faith, really. I don't know that it's unique. I don't know. I think it depends on if you trust yourself to do something else.
Adam	
Yes	I think that comes down to more what people's background is. You know, I had the minor in computer science and already had a strong interest in it, so I was looking at jobs in that particular field. But somebody that just comes out with, let's say, a bachelor's in meteorology, I don't know where they'd go from there if they didn't get a meteorology job. [laughs] If I were to go out on a limb, I would probably say, unless someone had an advanced degree in meteorology and that alone pigeon-holed them into working in meteorology only, the job market really I think is what dictates whether someone stays in or doesn't.
Danny	
Yes	I think it is a dirty little secret of the weather enterprise. I think it's fairly common but I don't think anybody wants to talk about it. I was at a conference, and the director of [organization] at the time was there. And he was talking to a couple of us off to the side, and he had mentioned that one of their student interns had gone on to become a financial broker of some sort. And we're all really kind of like, well, that's kind of a weird thing to go into with a meteorology degree! And he was like, well, it is until you stop and think about the fact that meteorology teaches you to make snap decisions using incomplete datasets, which is something that, when you study finances, you make snap decisions with incredibly complete datasets. But in the real world, you never have a complete dataset. That there's always something missing is something that's unique to meteorologists. And I had never considered that at that point, and that's the first time I had ever really considered that, well, I can get a degree in meteorology and go and do something else. I don't have to get a job in meteorology. I just look at the numbers. If you look at doing a rough estimation, the Weather Service has anywhere between 1,200 and 1,500 meteorologists on staff. And then if you stop and look at their hiring numbers for last year, they hired something around 50 people in from outside. And then we look at the graduation numbers for meteorology schools, and there are way more than 50 people graduating every year. And so when you take into account the fact

	that there's not a huge turnover in news anchor and television meteorologists— And private industry has grown, yes, but there's not 800 or 900 meteorology jobs every single year— And that number I'm sure is growing. I know that more and more universities are starting up meteorology programs, and that's only going to make this job market harder, because we're not making more meteorology positions. So it's good for the field, because they're going to have more of a choice. They're going to be able to find the more qualified meteorologists out there. But in terms of getting a meteorology degree, the value of that degree is going down. And so that's why I say it's a dirty little secret. Nobody wants to talk about it, but it's got to be incredibly common. The numbers don't lie.
Maggie	
Yes	And actually, I've talked to just about every single summer volunteer we've had, because they kind of make me do it, being the youngest person in the office. [laughs] But I like to talk to them. And I feel a little bit bad about this, but I tell them, keep your options open. There are a lot of other options out there. Don't just think you have to go into the public sector. The public sector is great, and it is a great job. I don't have any ill will towards the public sector at all. It is a great job. It's just not for me. And I've told the students this, and I've actually had a few of the students say to me that they're glad they had the opportunity to do that summer volunteer, because they see that it is not the career path for them. And their reasoning is the same as mine. They don't want to be in an office. They don't want to do the shift work. They want to be out doing other things. They don't know what their career path is going to be, but they know that it's probably not going to be the public sector. And so, it is a factor for some people, that drive is the same for some people. I wouldn't say everybody, but, yeah… So yeah, I guess the answer your question is, it is a factor for some people.
No	No, I don't think it's typical, because pretty much every other person in my office absolutely loves severe weather. And when it happens, they're just raring to go in the office and so excited about it. And I'm just not.
Becky	
Yes	Because of the shift work, I would like to say that it's probably not super uncommon for women to transition out of the public sector. It's tough. It's tough to have a family and work shift work. It's just tough, no matter how you look at it. Yeah, I mean, I think I have a unique experience, but I don't think it's all that uncommon. I mean, just being a female in… The public sector is tough in the first place. I mean, there's just the diversity side of it. The familial side of it. It's just a tough environment. You're up against a lot.

	And I truly believe you can do just about anything when you have any hard science degree. So that really helped me out. It gave me a lot of confidence to know that I could do something else. You really develop a keen sense of being able to do a lot of things when you have a meteorology background. You're really setting yourself up for success, even if it's not specifically weather-related.
Courtney	
Yes	When I started kind of going this way, I didn't think there was anybody else who did anything like this. So now I kind of see more and more articles about how there are a lot of people that do leave academia.
No	But I still don't think anybody has had a path that similar.
Jacob	
Yes	I don't know the numbers. I haven't done the research, but— And I'm assuming you will. But it seems like maybe there are more people studying meteorology than there are jobs available. That's kind of the odd thing about—and I don't know if any other colleges are different—but that's kind of the odd thing about my specific graduating class. I think we graduated 12 meteorologists, and I think maybe four or five are working in the field right now that I know of. Many of us have left the field completely. Frankly, I know of more people that I graduated with that don't work in meteorology than do.
Kim	
Yes	I thought it was funny that I just know so many people in meteorology who have ended up going to do [laughs] different things. And I kind of was like, oh, she's doing this study! There's probably a lot of people! I feel like it is typical for jobs of that nature, just because from what I've heard, at least, from the folks out in the wild trying to get jobs— And especially the two local places here, they just seem like they know that you don't have any other jobs to go to. So they came to people who are aspiring, people that just got out of college and they've got the degree that they want, and they just kind of chew them up. That's what I've really observed. And so I want it to not be common, but I feel like, at least in the private sector, it is more common than it really should be.

"Yes" indicates that the participant felt their exit was typical, while "No" indicates that the participant felt their exit was atypical.

APPENDIX H

Participant responses to questions about whether or not they would consider returning

Matthew	
Yes	I'm perfectly happy where I am, but I said, if I ever get unhappy, I'll think about coming back. If by chance I were to be let go or anything like that, I would certainly entertain the thought of coming back.
No	But this would've probably been about a year or so after that budget threat. They realized they were going to have a surplus of money, and so they were actually going to be hiring a lot of new people. And one of my former co-workers had reached out to me and said, hey, we're hiring. You should strongly consider coming back. I said, well, what all are the projects you all are working on? And I can't remember exactly what he said, but I thought, well, I'm perfectly happy where I am.
Linda	
No	**Can you think of anything that could happen in the future that might motivate you to go back to looking for jobs in meteorology? Or do you think that, that time is closed?** I think that it's closed, yep. [laughs]
Michael	
Yes	I don't try to ever take a job and say, I'm going to leave here! But I also have no problems, if the job I was hired in at a couple years down the line is not exactly what I want, or I see something better, jump for it. I would like to get back, but things would have to change. And I think it's going to have to be a big shake-up, like half the workforce retiring, to do something like that. [laughs]
No	Yeah, no. I don't really see myself coming back.
Adam	
Yes	Honestly, if I found another software development job that was related to meteorology and the pay was reasonable, I would do it in a heartbeat. If something fell into my lap that I couldn't say no to, I would happily take it. If a job happened along that would make use of my skill set, I would strongly consider it. And I would love to find one, I really would.

	Again, if something happened along that fit my skill set, and especially if I got that sort of impression that they would be directly impacting end users in a positive way, that would certainly help sway me.
No	So my desire to get back into meteorology, while it is somewhat strong, isn't strong enough to take a major pay cut to do it, if that makes sense. You really have to go looking for it, and I haven't felt the need to recently. [laughs] But again, it's not something I'm actively looking for right now either.
Danny	
Yes	I had co-taught three courses out at the training center for the public sector in [city], and I absolutely enjoyed it out there. And to this day, I maintain that is the only portion of the public sector I would ever consider working for.
No	I wouldn't, and that's purely because I've seen the inner workings of the public sector. I've peeled back the curtain and seen the man at the controls, and I don't like what I see, and I have no desire to be a part of it.
John	
No	No. No. The money's not there. I'm already making 20 percent more than when I left my old job. I got a raise as soon as I left my old job, and I got a 10 percent raise on top of that in my first year. I'm not going back. And that was after working at my old job for eight years. [laughs] So I had eight years where I just was like, [blows raspberry].
Maggie	
Yes	I think the only thing that I could see being a factor is if it was a necessity for family needs. If down the line when I get married, if it comes up that I have to move away and that's the only way that I can get a job is to go back into meteorology, that would probably be one of the only instances that I could see myself going back. And it probably wouldn't be very willingly.
No	I want to say most likely no. Not by choice or for the interest of it.
Xavier	
Yes	And I [laughs] occasionally think, if I were to at this moment stop what I'm doing now and go back to the public sector, I would totally do so, as long as it was in sufficient enough of a leadership role that I could actually make change their recruiting tactics, their on-boarding tactics, probably some of the personnel management, and make the whole thing much more of a modern workplace.

	It would take a lot of very serious changes in the government to allow for a position like that, where one can actually come in and make drastic changes. So it may be a little bit of just kind of a… [sighs] I don't know what the right word for it is. Like a fantasy kind of job position where, if you could come in and just make everything more efficient and better, then you would allow people to actually become better at what they do, as opposed to just being so caught up in these processes and all of the hoops that you have to jump through that it's almost prohibitive as far as that goes. [laughs] So, semi-, medium-seriously.
Jacob	
Yes	Yes. In fact, I actively still am and I have always been. I'm sure there have been stretches of a few months where I haven't been looking, but for the most part, I make an effort every week. Actually every Wednesday, I look for jobs, and if there's any that I feel I am qualified for, I try to apply. As far as the National Weather Service goes, I have been— What is it referred to? The official… Whatever that first step is. I've made panels in the past. I think the most recent one I applied to, I do not believe I made a panel, but usually when I apply to the positions, I would make the panel… And like I said, I've essentially said that I don't want to do television. Could I get a small market TV job? Maybe I could. I would like to think I could.
No	And like I said, I've essentially said that I don't want to do television. Could I get a small market TV job? Maybe I could. I would like to think I could. But that would probably also at this point mean a significant pay cut from an already relatively low salary. I'm not willing, and frankly, I don't think I could afford to make that choice. Even if I wanted to pursue TV, I don't know if I could afford it.
Becky	
Yes	Yeah, I think about it every day. [laughs] It's something that I think about all the time, and it's definitely something that I would want to pursue. If we moved somewhere else, I don't think I would hesitate at all to try and get a job.
No	But again, I'm kind of in a weird location where there isn't a whole lot for me to do here. And that's always been the limiting factor. I don't think it'll be the public sector again, just because… I feel like it's

	changed a lot since I've been out. I know people that are in and other people that have gotten out, and it just seems like a very tumultuous place. And that's not saying anything against the public sector. It's more of the federal government as a whole. I think, especially seeing it from the business side, just how things run, their business is not something that I would want to be involved with again. And that's not a dig at the government or anything, but it's just, it's not… Their business practices are not in line with how I would run operations. So I don't know if I would want to do that again.
Courtney	
Yes	If I lived somewhere with a reasonable college, I would absolutely consider going back to that. If a position came up and was teaching and research I think it would be really awesome.
Kim	
Yes	I absolutely would, if the opportunity presented itself. And if I would do something that kind of combines the two things I've done now, meteorology and IT, I think that would be really awesome. But yeah, I would always be open to going back. But I know that it's a real hard transition to make back in because it's always changing. And once you've been out of the game for a while, I know sometimes folks go, well, they don't know about this new thing that happened, or they're rusty. And forecasting isn't exactly and easy or low-stress thing, and it's got a high cost if you really screw up. So I feel like it would be difficult, but I would definitely be willing to give it a shot.
David	
Yes	But if I could find something that could allow me to do that job but remotely from my house or from even my office at my other company, I would definitely consider it. It's just, at some point… In my mid-30s, do I need to uproot everything again? [laughs] To go back out and start from the bottom again and working the weekends? But if I can work the weekends here from my house without having to worry about paying for two mortgages while I sell one house, all that stuff. Yeah. I never say never. But it would have to be kind of something that really would fit not just my career pace, but my personal lifestyle as well.
No	So I thank them for their offers, but I wasn't really planning on going back, and I'm not going to go back if it's not right for me. I'll call my one friend that still works down there, and he'll just launch into, you won't believe this! He always says, don't do this again on the overnights.

	I'm like, that's right. That's why I got out of all that. [laughs] It's a kind of a reminder of, if the job was what wanted to make you leave, then other things will probably still be there. Because I've been back here now for four years. I bought a house. I've been reconnecting with friends and family. It's going to be hard for me to leave that again.
Valerie	
Yes	If I could find something that blends training and development with weather, fantastic.
No	**So, do you see yourself in the future ever looking to get back into a meteorology job?** I don't think so. Well, you make way more money in tech. [laughs] And the job, it's way more relaxed and the benefits are way better. But I'm pretty sure [organization] is the only real opportunity for that.

"Yes" indicates that the participant would consider returning to the atmospheric science occupation, while "No" indicates that the participant would not consider returning to the atmospheric science occupation.

APPENDIX I

Selected relevant meaning units for discussion of the conundrum of satisfaction

Matthew
I don't know if this is a question you'll be asking down the road or whatever, but I have to say that where I am now— I wouldn't be able to be here if it weren't for my previous job in meteorology, because it just so happened, this thing got dumped in my lap, to help out with [job task details]. So that wouldn't have come around had I not had my job in meteorology. So by no means am I bitter or anything. I still look back on it… By and large, the vast majority of my memories whenever I look back on it are positive.
Linda
But I did enjoy… I made great friends. I don't miss that. Don't miss that at all. That was great. Just the growth as a person in doing that was something I enjoyed. It was definitely a challenge. It was showing me other sides of meteorology. That was the other great part about this company was I got to use my degree in different ways and learn about these things. That was something I really enjoyed about the company, was it expanded my horizons quite a bit. And like I said, I liked every position better within the company. It was eye-opening in that way, because I just saw other opportunities that I hadn't seen before.
Michael
So and I spent a year-and-a-half there and absolutely loved it. The wonderful, laid-back environment… People there were really professional. But you're in the belly of the public sector bureaucratic beast. There was just so much red tape. And you really got to see how dysfunctional and how kind of away from meteorology— I don't know how to say this. When I was in [city], we were doing pure weather. I was doing pure weather. There was some bureaucratic-ness, but it really kept itself out of the forecasters' way. So you just kind of went to work, did what you were supposed to do, and that was that. By 2013, things were very different. The sequester had really taken its toll on morale. Training was butchered. And they were trying to bring it back, but it was a different organization from when I left it. So, I loved my job at [organization]. I spent two years there as a contractor and was like, well, what's the next stage? I still kind of feel like I've totally like— Did I waste those four years doing a meteorology degree? And I know the answer is no. I learned a lot of good math and

statistics skills, and there's a lot of skills I learned while getting that degree that helped me in grad school and everything. But I'm like, I really wanted to be a meteorologist, and that's why I got into meteorology, and that was always something I wanted to do. But things change, and I had fun while it lasted, but if that were today, I wouldn't take it. I want to go to a place that I know is growing. It has stability and will have a good future.
Adam
So even to this day, I'd say this was probably one of the best jobs I've had, salary aside and all. That job, the first one, pretty much settled me that that's what I wanted to do. I would have loved to have stayed doing meteorological software development.
Danny
So I really enjoyed it, enough that I went and got a job there once I graduated, so I must've enjoyed it. [laughs] But it wasn't really what I wanted, because it wasn't forecasting. It was physical science, it was instrumentation and electrical engineering, that type of thing, but it wasn't forecasting. So I don't think I was ever truly 100 percent happy with doing that. I mean, I very much enjoyed it, but it wasn't exactly what I wanted to be doing. It wasn't the forecasting, it wasn't using what I had learned for three-and-a-half years of school.
John
Looking back, I hated that job, and I loved that job at the same time, because it allowed me to have the life I have now. And honestly, I have no problems with anybody at the company. It's just financials. It's numbers. As much as I hated it, it was ripping the band-aid off. It was one of those things where it was going to happen, and like I said, I have no ill will. Imagine… You always have a place in your heart for your first love. And you think about your first love, there may or may not be a reason why you're still not with them. But you look at the nostalgia of it. [laughs] Like I said, you always have a place in your heart, but there's a reason you're why not together anymore.
Maggie
There's something I'd like to say about working for the public sector. Even though it's not where I feel my career is supposed to be long-term, I still feel like it was a necessary part of my career. And I say that because there were a lot of opportunities that I wouldn't have gotten if I'd spent my whole career at [outside organization]. [details about mentorship program] So I think that that was a necessary part of my career to grow personally and professionally by being with the public sector. And

there's a lot of other things that I've done here that have helped me, but the key one was working with my mentor. […] And I don't think I would've been able to progress and be as self-confident as I am now if I had not come to the public sector.

The public sector is great, and it is a great job. I don't have any ill will towards the public sector at all. It is a great job. It's just not for me.

I am proud of that. It's a hard degree to get, and it's something that's still really cool. But I just prefer the work in my previous occupation.

Becky

I loved my office. It's funny. When I first got there, it was terrifying. First time on my own. The staff was just phenomenal. It was a bunch of middle-aged white men. [laughs] But being a 22-year-old female recent college graduate, they all kind of took me under their wing. And they were just the most wonderful, kind men that I could have ever asked to help me adapt to my new situation. They were so helpful in teaching me new things and encouraging me and just helping me out with little things. Oh, I don't know where to get an apartment, blah, blah, blah. They were awesome. [sighs] You're going to be so angry at me because I'm so happy, I was so happy at my office. [laughs] They were just so wonderful. And there was a lot of turnover in the second two years that I was there. But there was something magical at that office. It was just a great mix of older and younger and we just… They were just great. [laughs] They were really good there.

I loved the job so much, I stayed in [state] for two years while he was living in [other state].

Oh, it was awful! I loved the office so much. I mean, the staff there was just— I loved each of them like they were my brothers, like they were my dads, sisters, moms. We had a very close bond. We did a really good job, and I learned so much from the people there. I didn't want to move. [laughs]

And I think part of the reason I liked the office so much is because it was more familial. We had such a good time together and we learned so much together…

I wish I could still do it. [laughs]

I like the weather too much to be doing anything else, if that makes sense.

Jacob

Well, I mean, it was a great… This was always kind of the catch-22. It was a great place to work for. The people I worked for were great. But on a daily basis I really wasn't forecasting the weather myself. And so, as far as the job specifically goes, I would say I did not really enjoy it.

So I would not say I hated it, and certainly there are plenty of worse jobs out there. But specifically on a day-to-day basis, I didn't really like it because, especially the second time around, it really became a research-driven role. And so you were supposed to follow social media and follow news stories and try to get video and that sort of stuff. And it actually got to the point where, if I had to watch the Weather Channel, I couldn't do it, because I kept thinking about the things that were happening in the background that the producers or whatever were going to have to do. Obviously having a knowledge of weather and being a meteorologist helped. But I wasn't really doing meteorology. I was pretty much just a researcher or a producer. And so it wasn't a horrible job, but I wouldn't say I particularly liked it.

And so, it wasn't a horrible job. But I wouldn't say I particularly liked it.

I actually was— And I was told this, I'm not trying to be cocky or anything. I was very good at the job. But at the same time, I was very miserable.

Valerie

It was a really good place to work. It was kind of a nice, friendly environment, which I really liked, and very laid-back. It was a nice change of pace.

The technical writing side of me was being developed. So I just helped wherever I could, doing whatever I could. But the things I enjoyed the most were developing print materials.

I really kind of got into the training side of things. I got a little bit deeper into training and understanding training and development.